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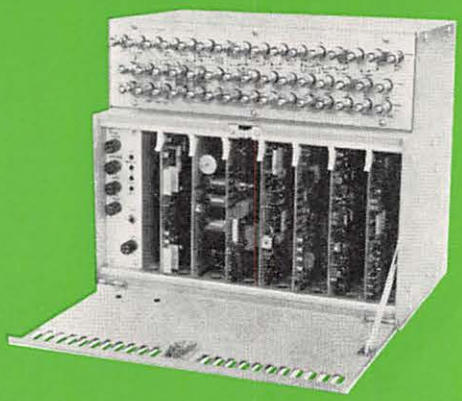

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"Covering All Communications, Data Processing and Signaling"

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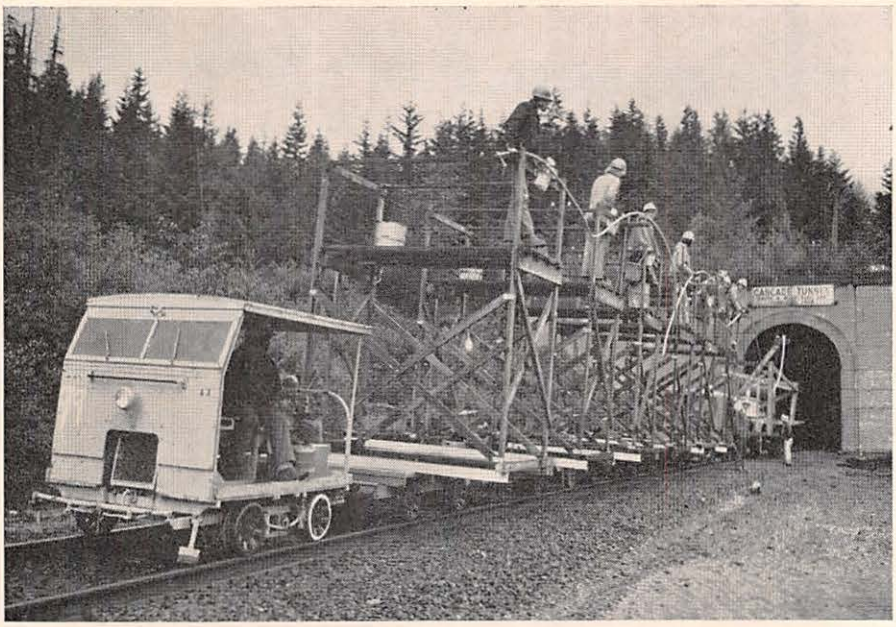

BN expanding slave-unit use

Burlington Northern is on its way toward beating the "tunnel" problem involved in the operation of remote-control helper locomotive units. Late last year, BN installed new radio equipment in Cascade Tunnel in western Washington, which will permit use of slave units early this year. Similar installations are planned for the Flathead, Bozeman and Blossburg Tunnels, all in Montana. (Cascade, at 7.8 miles, and Flathead, at seven miles, are the two longest railway tunnels in North America, and rank seventh and eighth in the world.)

Until now, BN has been operating remote-control helpers on unit trains in the Midwest—but the operation has not been extended into mountain territory because of the communications problems in long tunnels. In the Cascade project, BN installed two ⅞-inch coaxial cables to carry and distribute radio signals; vacuum-tube radio facilities were to be replaced with solid-state units. With working time in the tunnel severely limited—to avoid train delays, crews were able to work only between about 10 a.m. and 2 p.m.—BN devised a production-line system to drill the more than 4,200 three-inch-deep holes in the concrete tunnel lining and place the cable brackets. The cable "train" consisted of a motor car and a trailing unit which provided elevated work stations for six men. Three portable generators were used to provide light and power the hand-held drills used in the mounting of the brackets.

Through use of the slotted coaxial cable, high pass filters, low pass filters and receive signal comparator circuits, it's said, continuous communications can be provided with a minimum amount of repeater equipment. (See report on Santa Fe's use of repeater equipment in connection with slave-unit operation, p. 24.)

Conference sets "energy" theme

The 1974 Joint Railroad Conference of The Institute of Electrical and Electronics Engineers and The American Society of Mechanical Engineers will have an appropriate theme: Rail Transportation—Energy Crisis Superstar. IEEE and ASME members will hold this 17th joint conference April 2-4 at the Hilton Hotel in Pittsburgh.

Among the major subjects to be covered will be energy utilization, high-speed railroading, train dynamics, fatigue testing and automatic yard control systems. Two sessions are scheduled on train behavior and the application of train-behavior knowledge to equipment design; other sessions will take up methods for more efficient movement of cars through yards through use of improved process-control and management-information systems employing digital computers. Among the speakers at the conference will be George Krambles, operating manager of the Chicago Transit Authority.

Servo develops system for aci label-cleaning

There is a very good chance that something will be done this year about the problem of dirty automatic car identification labels. For one thing, Larry Cena, vice president-operations of Santa Fe, is heading up a top-level AAR committee to look into the problem and make recommendations about a solution. Included are operating, mechanical, signaling and communications officers of other roads. They should have some "clout" in getting the job done.

• **Servo offers a plan.** For another, a two-phase plan is being proposed by Servo Corp. of America to ultimately bring aci label readability up to the 95+% level, say by 1976. Servo—the KarTrak aci manufacturer—proposes in Phase 1 a crash program to manually clean aci labels next summer. The work will be done from April 1974 through September with multiple crews working around the clock. This will be a one-time cleaning process carried out at 15 major gateway hump yards. Servo proposes to do this on a cost-plus fixed-fee contract, and pro-rated to individual railroads on a car-ownership basis. (Servo was planning to present AAR with specific cost data in January 1974.)

Phase 2 would consist of the installation, operation and maintenance of automatic label-cleaning systems at major hump yards for a flat-rate charge per car per year, with costs pro-rated to railroads on a car-ownership basis. This proposal may be made by Servo to the AAR in March.

Phase 1 is expected to bring aci label readability from its present 80% average level to about 90%. For the automatic cleaning system usage, label readability is expected to reach the 95+% goal, probably after one year of operation. It is expected that 90% of the car fleet would be cleaned with automatic systems during the first year of operation, and that by the end of 1976, close to the entire car fleet would have been through a label cleaner.

• **Automatic cleaning too.** The automatic aci label cleaning system would use four scanners—two on each side of a hump approach track positioned in approach to and beyond the

(Continued on page 8)

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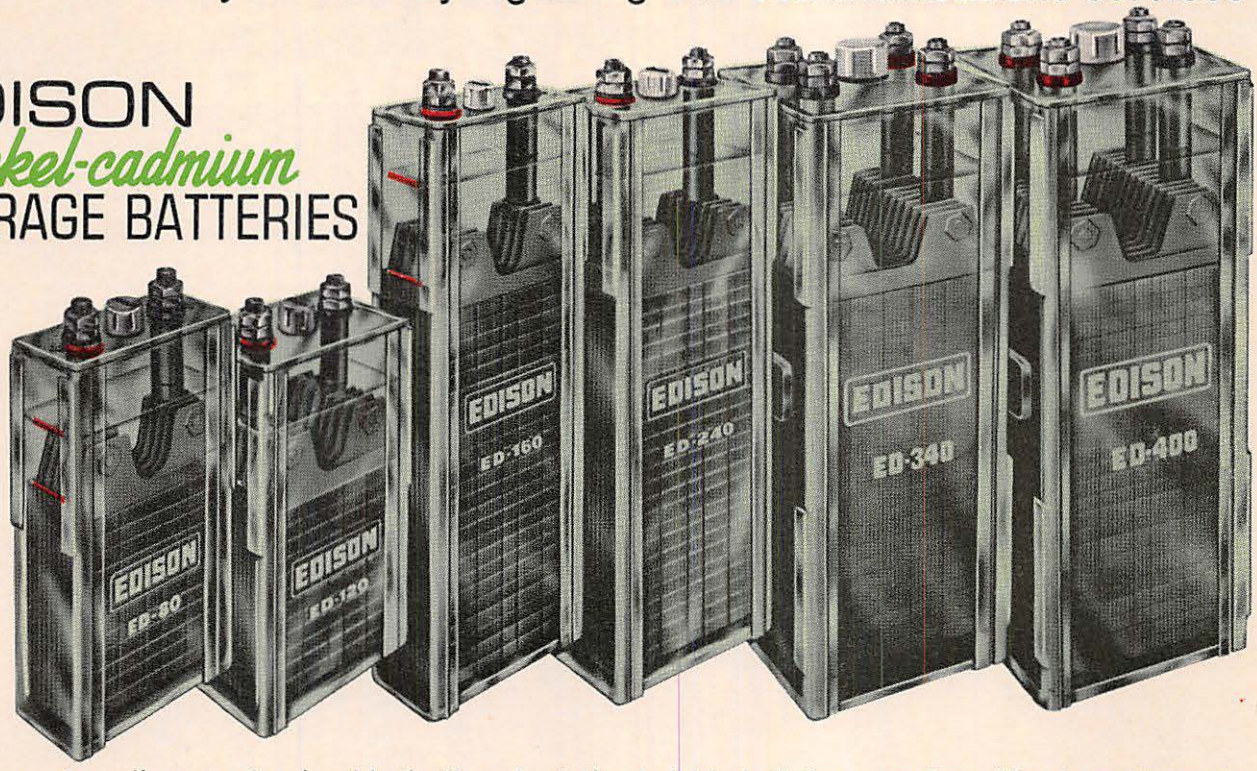

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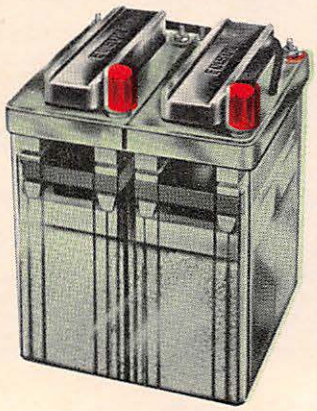

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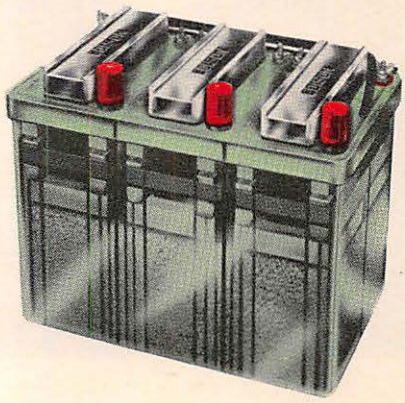

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26C	1	150-2400
26C/40.8	1	20,400/40,800
26D	1 plus secondary 150 b/s channel	4,800
26U/1200	1	1200
9003A	1-8 1-2	50,000 250,000
9005A	1	50,000- 250,000
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RSC News

(Continued from page 4)

automatic cleaner. Basically, the plan is to use a device that will spray a hot water-detergent mixture at the aci labels on the passing freight cars. The two aci scanners beyond the cleaner would provide quality control checks on the cleaning application. Readouts of before-and-after cleaning of labels could be fed to printout equipment in the local yard office, as well as to a central data processing unit for statistical usage.

System specifications include the following:

—Positive cleaning of dirty labels to make them readable.

—Cleaning accomplished while car is "in motion."

—No delay to train.

—No railroad personnel required for operation.

—No safety hazards.

—Full ecological approval.

—Compliance with all railroad, government and labor union requirements.

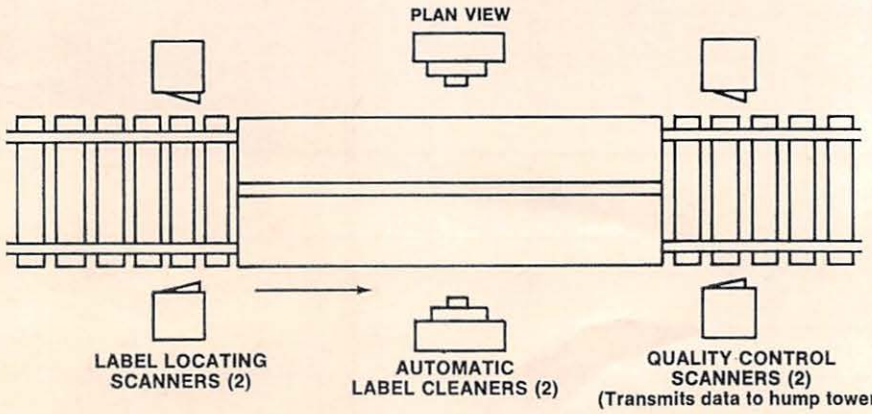
Some 26 cities have been tentatively proposed by Servo as suitable for gateway automatic label cleaning installations. High traffic densities have been a key factor in the selection of these gateway locations.

Gateway City	Railroad
Moncton, N.B.	Canadian National, CP Rail
St. John, N.B.	Canadian National, CP Rail
North Bay, Ont.	Canadian National, CP Rail
Capreol, Ont.	Canadian National
Selkirk, N.Y.	Penn Central
Buffalo	Erie Lackawanna, Penn Central
Alexandria, Va.	Richmond, Fredericksburg & Potomac
Jacksonville, Fla.	Seaboard Coast Line, Florida East Coast
New Orleans	Southern
Houston	Southern Pacific
Atlanta	Southern
Memphis	Illinois Central Gulf, Frisco
Cincinnati	Penn Central
Detroit	Detroit, Toledo & Ironton, Penn Central
Chicago	Burlington Northern, Soo Line, Milwaukee Road, Belt of Chicago
Minneapolis	Burlington Northern
St. Louis	Terminal Railroad Association
Kansas City	Santa Fe
Lincoln, Neb.	Burlington Northern
North Platte, Neb.	Union Pacific
Winslow, Ariz.	Santa Fe
Barstow, Calif.	Santa Fe
Colton, Calif.	Southern Pacific
Roseville, Calif.	Southern Pacific
Portland, Ore.	Southern Pacific, Union Pacific
Pasco, Wash.	Burlington Northern

The automatic cleaning systems would be installed beginning in mid-1975 and be completed by the end of that year.

• **Cost elements important.** Cost elements in present rail-operated label-cleaning systems include rip track, crew time, materials cost, switch-engine time and car per-diem costs.

Cost elements in the proposed Servo system include a flat rate per car per year, with no railroad capital investment, no railroad personnel required, and no railroad materials cost.



WHAT SERVO HAS IN MIND is an automatic system in which cars will pass by label-locating scanners, then through the area where labels will be cleaned, and finally past another set of scanners as a quality-control check.

Hansen heads RSS

John W. Hansen, manager-marketing services of WABCO, is the new chairman and president of Railway Systems Suppliers, Inc., succeeding Robert G. Lewis, president of Simmons-Boardman Publishing Corp. and publisher of the Railway Age group, including RSC.

Other officers elected for 1974 by RSS are: Executive vice president, Robert B. Wyland, president of Safetran Systems Corp.; first vice president, Frank Richter, publisher of Progressive Railroading; second vice president, Edward H. Cole, assistant vice president of Western Union; and secretary and treasurer, Frank Aikman, Jr., executive director of RSS.

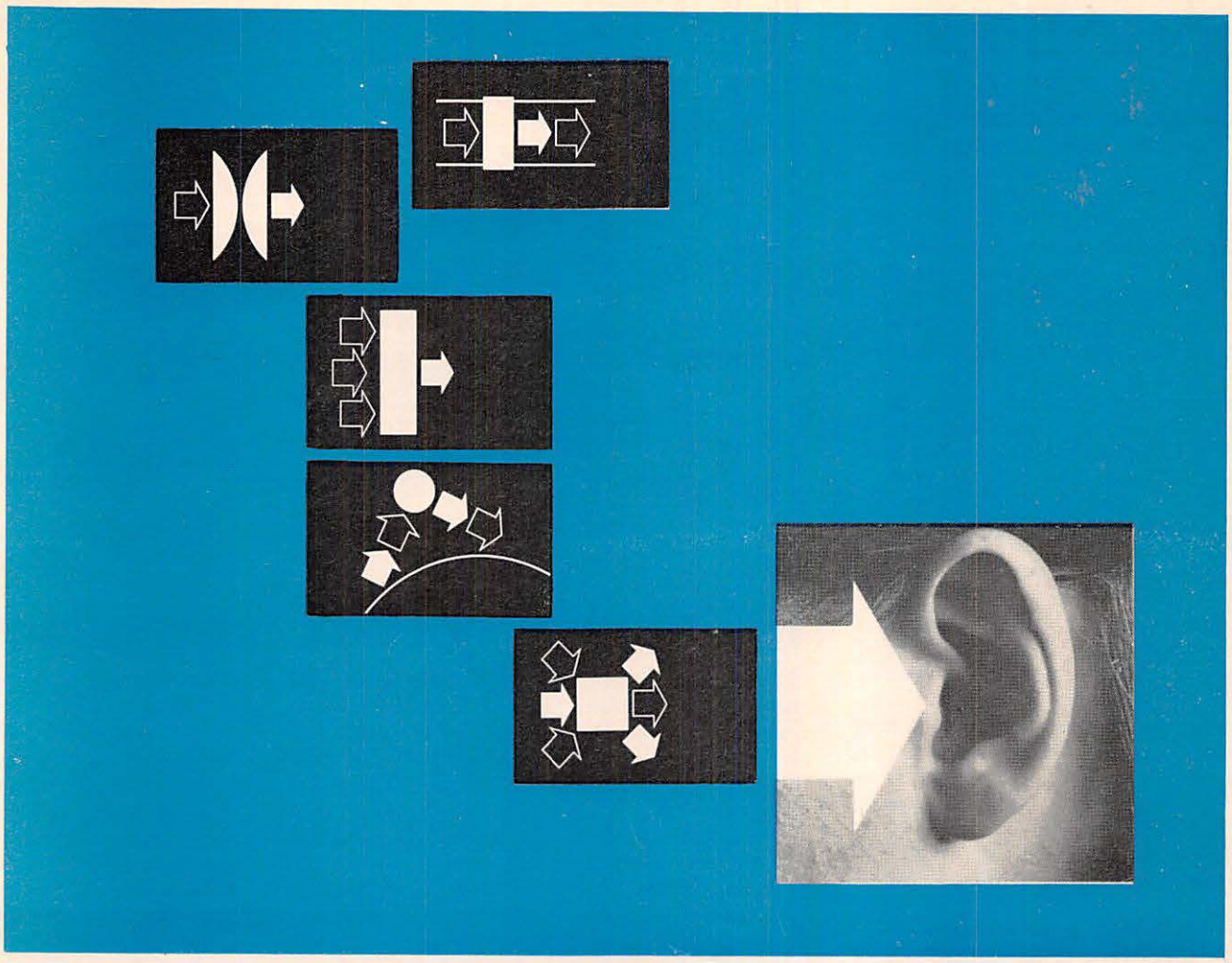
Railway Systems Suppliers, now numbering 129 member companies, will hold its 1974 exhibit Sept. 16-19 at the Regency Hyatt House in Atlanta, in conjunction with annual meetings of the AAR Communication and Signal Section and Data Systems Division.

Southern, NS merge

At least one railroad merger will take place in 1974: Southern, with ICC approval, was planning a Jan. 1 consummation which would merge 624-mile Norfolk Southern with Southern subsidiary Carolina & Northwestern. Southern will own all the stock of the surviving company, which will adopt the NS name.

Norfolk Southern, which has been independently-operated, has principal connections with Southern at Charlotte and Raleigh, N.C. Its operations are concentrated in southeastern Virginia and the eastern and Piedmont areas of North Carolina; merger will enable

(Continued on page 10)



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(Continued from page 8)

Southern to operate over its own lines to serve the entire Hampton Roads area of Virginia (which ranks as the fourth largest port area in the United States). In addition, NS territory has good industrial-development potential: Volvo has chosen an NS site for its first U.S. automobile assembly plant, and Southern has purchased the 256-acre site of the former Raleigh Municipal Airport (also on NS) for industrial and commercial development. As for other 1974 mergers, it's anybody's guess—with the big one, Union Pacific/Rock Island, still stalled.

Signals installed

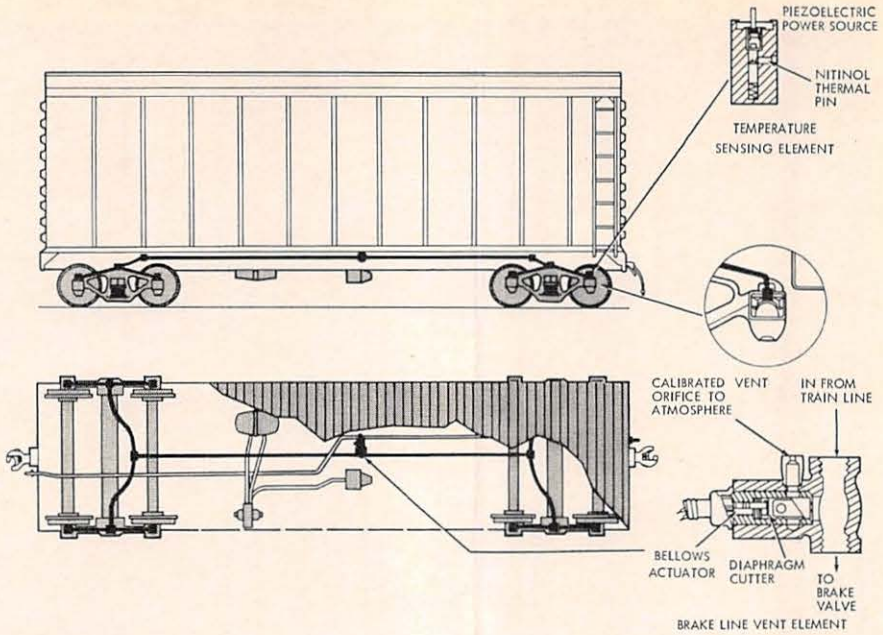
Chicago Transit Authority has begun installation of GRS cab-signal equipment on 500 rapid-transit cars serving the system's North-South, Ravenswood, Skokie Swift and Evanston routes, the only lines not heretofore afforded signal protection with train-stop devices over their entire length. CTA expects to complete the installations in about a year and a half. The project is part of a $21-million program to complete the signalization of the full CTA rapid-transit network.

Safetran expands . . .

Expansion is the order of the day for Safetran Systems Corp., with plant additions completed at Louisville and under way at Cucamonga, Calif., and Minneapolis. With these expansions, it's expected that production can be increased by as much as one-third—and more expansion may be ahead. The recent passage of the 1973 Highway Act could produce a need for still more manufacturing capacity, and Safetran has already completed preliminary planning for other plant additions.

. . . as does Harmon

Rapid growth, especially in railroad electronics, has led Harmon Industries, Inc., into a plant expansion and rearrangement project. The company is now operating a new plant at Grain Valley, Mo., and it's consolidating several other plants located in Blue Springs and Grain Valley. The new facility, a one-story 24,000-square-foot structure, puts everything in Harmon's electronics division under one roof, including manufacturing facilities for railroad grade-crossing hardware, a sheet metal and paint shop and shipping room. Another plant formerly used mostly for railroad electronics will now be used for R&D and for manufacture of products marketed outside the railroad industry.



NOL studies hot-box prevention

Though the railroad industry's record on hot-box setouts has improved tremendously over the past 20-or-so years—setouts are now down to roughly 15,000 per year and the setout rate per million car-miles is less than one-half of 1%—the search goes on, among railroads, suppliers and others, to make the record even better.

Among the latest ideas—this one developed by the Naval Ordnance Laboratory, working with FRA—is use of a sensor system, journal-box mounted. NOL says this self-powered thermal sensor "is rugged enough to withstand shock and vibration on the unsprung journal box. In military tests simulating such conditions, its key components have demonstrated an essentially zero false-alarm rate and a life expectancy of at least four years."

NOL describes the installation and operation this way: "A sensing element is mounted adjacent to the bearing of each wheel and is electrically connected to a brake-line vent element on the individual car. An intermetallic nickel-titanium alloy pin in the sensor undergoes a sudden phase change, shrinks in length and releases a spring-loaded firing pin when a bearing heats above a safe temperature. The firing pin initiates an explosive primer that in turn crushes a piezo-electric crystal, to generate a very-short-duration electrical pulse. This pulse goes to a self-contained explosive-actuated valve on the car's existing air-brake system, venting air from the brake line at a rate that automatically makes a normal brake application throughout the train."

NOL recognizes the strides that have been made in hot-box reduction. Its point is that "effective inspection must be made at the point of incipient failure"—and that railroads have not as yet been financially able to space detectors closely enough to catch some hot boxes before they cause trouble.

While NOL gives no estimate of what installation of the sensor systems might cost, it does say that its feasibility study has been completed and "results look promising from both engineering and economic standpoints. The concept is under evaluation by DOT to determine if the technology can be transferred into actual use."

New expansion plans for SPCC

Southern Pacific Communications Co. expansion plans are moving ahead, as the company pursues its goal of becoming a national specialized common carrier. In one move, SPCC has reached agreement to acquire all outstanding shares of Microwave Associates' wholly-owned subsidiary, Video Microwave, Inc.

In another, SPCC has plans for acquisition of United Video, Inc., subsidiary of LVO Cable, Inc. Video Microwave has permits and pending applications covering a video microwave system linking New York, Albany and Boston. United Video has been building a specialized voice and data telecommunications system linking Dallas, Oklahoma City, Tulsa, Kansas City and St. Louis, and has applications in for construction and operation of about 3,800 additional route miles of data and voice microwave transmission facilities.

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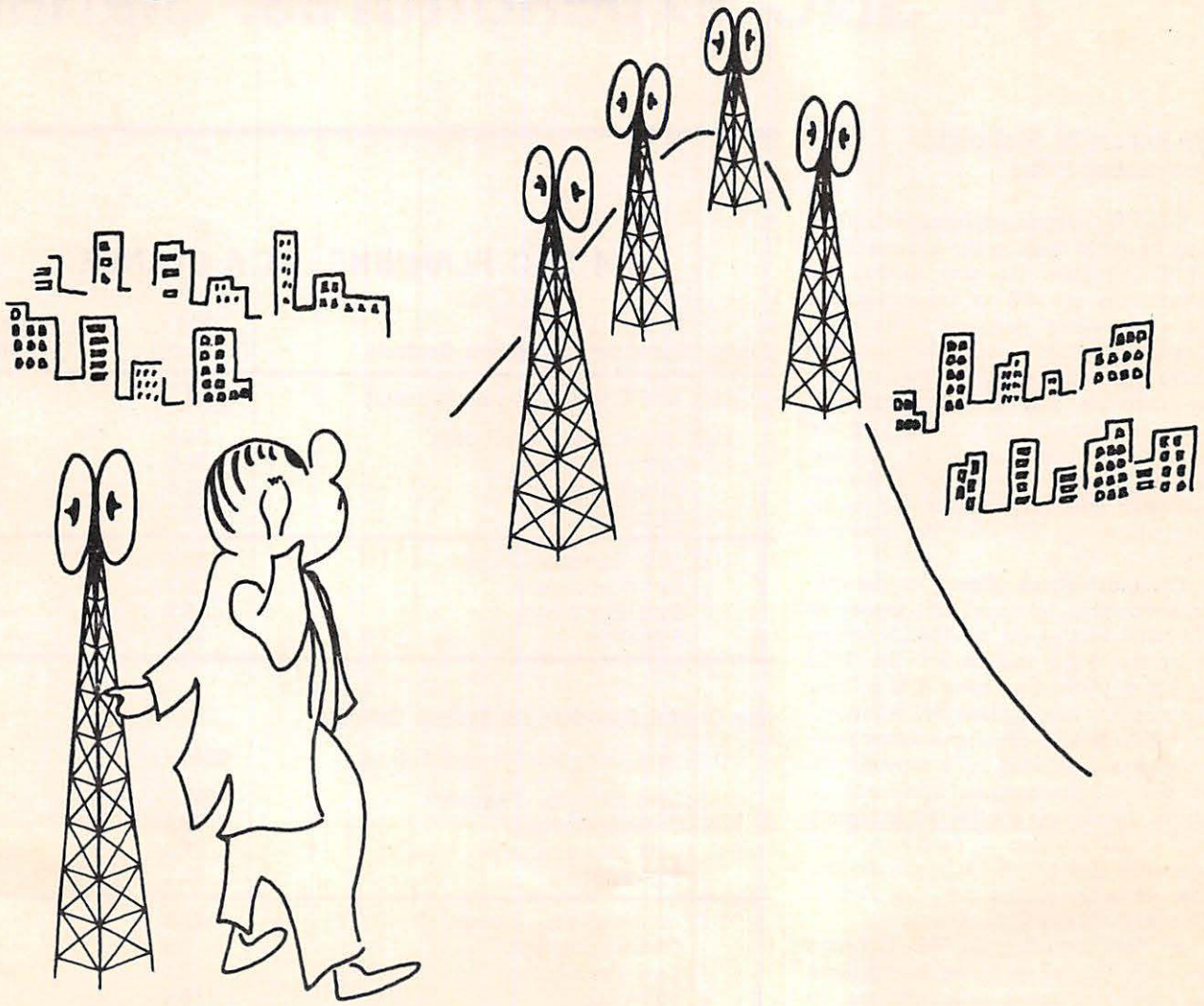

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GROUPE CGE

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'74 S&C expenditures: Signaling

By Robert W. McKnight
Contributing Editor

For 1974, signal engineers are planning to spend more money than in 1973 —$147.1 million for new capital improvements as well as for equipment for maintenance purposes. This is an increase of 14% over the previous year's planned spending. Broken down by railroads and transit authorities, spending plans for the coming year are as follows: $105.4 million for railroads in the U.S. and Canada, up 17% from last year; and $41.7 million for transit authorities, up 8% over the previous year.

Communications officers, on the other hand, plan to spend less money in '74—23% less, down to $138.5 million from the $181 million for the 1973 spending plans. For many it is a "time for a review of our plans for the future," as one railroad's communications engineer phrases it. Still, 1974 expenditures in the communications area will be above the average for the last five years, and could increase if American Telephone & Telegraph Co.'s private-line-rate issue is settled by the Federal Communications Commission.

• **More signaling in '74.** For new projects, capital spending in signaling, railroads and transit authorities may be up by 12% from last year, to a total of $68.7 million. Major projects listed in the returns to the *Railway System Controls* annual survey reveal that centralized traffic control, highway grade-crossing protection devices and safety detectors are high on the list of priority items for installation in 1974.

Preliminary indications are that ctc will hold up well again in 1974 with 809 road miles reported as being planned for installation. Two major trends continue in the ctc area: (1) Reverse signaling and full ctc for double-track main lines; and (2) consolidating controls at railroad headquarters or at major dispatching centers. Some of these ctc consolidations include use of minicomputers for some automatic control and data collection and display. In this connection, some railroads are studying or implementing automatic train dispatching using computer simulation techniques.

Also in the ctc area, at least two roads, one of them the Chicago & Western Indiana, have replaced conventional ctc and interlocking control machines with a minicomputer control using cathode ray tube terminals for track diagrams and pushbuttons for dispatcher's control. C&WI has consolidated the control of several interlockings and line-of-road into this new control concept.

'74 S&C PLANNING, AT A GLANCE

Capital Spending for System Controls	1974 (Millions)	Change from 1973
U.S. and Canada—RR and Transit	$129.2	−10%
U.S. and Canada—Railroads	95.8	−10
Communications	51.2	−24
Data Processing	2.4	−33
Signaling	42.2	+17
U.S. and Canada—Transit	33.4	− 8
Communications	6.7	−34
Data Processing	0.2	−75
Signaling	26.5	+ 5
Non-Capital Spending for System Controls		
U.S. and Canada—RR and Transit	$265.5	− 3%
U.S. and Canada—Railroads	238.2	+ 4
Communications	76.6	−23
Data Processing	98.4	+16
Signaling	63.2	+17
U.S. and Canada—Transit	27.3	−23
Communications	4.0	−15
Data Processing	8.1	−54
Signaling	15.2	+14

• **Crossing protection up?** Passage of the Federal Highway Aid Act of 1973 should do much to stimulate activity in the railroad highway grade-crossing protection area. Preliminary figures from the annual *RSC* survey show that 512 crossings are slated for automatic protection in 1974 by U.S. and Canadian railroads. Admittedly this is about one-third of the normal figure that can be anticipated to be installed, but it is still encouraging because it is an early indication.

Admittedly, too, late passage of the bill last fall—and there was some doubt about whether there would be sufficient funds for crossing protection—caught many states and railroads with little planning completed in the grade-crossing area. Also, included in the provisions of the bill is a requirement for states to submit plans to the Secretary of Transportation concerning programs to improve grade-crossing safety with specific crossing locations pinpointed for improvement. In this respect, the FRA/AAR jointly-sponsored program of developing a grade-crossing inventory is proceeding well.

• **Safety detectors strong.** Installation of safety detectors remains at relatively high levels. Last year, railroads installed 140 hotbox and 319 dragging equipment detectors. Indications are that for 1974 high-level activity will continue. Many railroads are following the practice of installing dragging-equipment detectors at all hotbox detector locations. Thus, they can utilize

up— but communications down

SIGNAL EQUIPMENT INSTALLED 1969—1973

	1969	1970	1971	1972	1973
Traffic control and block signal systems					
Track Miles*	1,072	1,553	892	1,089	1,529
Signals	881	1,139	601	974	1,068
Power switches	160	274	208	260	231
Electric locks	189	285	135	225	278
Train stops	90	27	150	91	44
Rolling stock with cab signals or automatic train controls	101	723	135	100	230
Classification yards	5	7	13	10	9
Retarders	17	12	22	21	171
Power switches	168	115	148	66	304
Highway crossings protected					
With flashing-lights only	913	1,010	986	935	884
With flashing-lights and gates	504	572	598	596	489
Interlockings	45	57	41	57	76
Power switches	189	260	268	169	226
Signals	218	314	443	217	184
Safety detectors					
Dragging equipment	165	90	126	193	319
Clearance (High-wide load)	9	5	7	7	4
Hotbox	168	151	161	219	140
Loose or broken wheel	34	13	88	10	4
Slide fence, feet*	7,212	21,084	26,005	17,561	38,018
Other signal devices	940	1,059	860	726	631
Totals	**4,796**	**6,086**	**4,990**	**4,867**	**5,292**

*Excluded from totals

COMMUNICATIONS EQUIPMENT INSTALLED 1969—1973

	1969	1970	1971	1972	1973
Miles of aluminum wire or cable installed*	1,252	3,077	1,781	1,932	1,468
Miles of copper wire or cable installed*	1,755	2,345	1,644	1,509	1,505
Carrier equipment installed					
Terminals and repeaters					
Voice only	1,884	2,264	1,576	1,824	1,793
Speech plus data	632	308	270	304	255
Data only	2,274	424	274	408	425
Microwave stations	186	335	32	89	165
Printing Telegraph machines	5,176	2,688	1,876	321	1,850
Computer Input/Output Devices	558	872	307	522	375
Data Sets	1,059	934	793	839	1,037
Automatic Telephone Exchanges	54	31	25	25	25
Stations available	3,962	2,280	2,592	2,055	2,201
Radio					
Mobile units	3,448	4,032	4,542	4,200	3,905
Fixed stations	513	667	494	473	631
Portable units	2,342	2,944	4,017	4,035	7,938
Intercom Systems	75	113	72	116	108
Loudspeakers	1,010	3,854	1,116	713	1,544
Telephones	848	694	1,673	1,096	2,436
Automatic Car Identification Scanners	30	33	68	94	109
Other Communications Units	210	36	186	33	126
Totals	**24,261**	**22,869**	**19,913**	**17,137**	**24,923**

*Excluded from totals

OVER 100 ACI SCANNERS INSTALLED IN 1973

Railroad	Carrier Equipment — Terminals & Repeaters: Voice	Voice & Data	Data	No. of Teleprinters	No. of Computer I/O Units	No. of Data Sets	Pole Line or Cable Construction: Miles of Wire &/or Cable	Miles of Aluminum/ Copper	No. of ACI Scanners
BART (San Francisco)	22	—	12	2	2	—	—	—	10
B&LE	—	—	—	—	21	17	3W	3C	8
BN	272	—	48	59	—	48	10C	—	17
CN	678	230	221	1,712	113	491	1,468W, 239C	1,468A	13
CNJ	—	2	—	—	1	8	3W, 1C	3C	—
Chessie System	5	—	—	42	84	76	110W, 5C	110C	17
C&NW	156	—	4	3	5	65	400W, 16C	400C	5
C&WI	—	—	—	—	—	—	4C	—	—
CTA (Chicago)	—	—	6	—	—	—	3C	—	—
CTS (Cleveland)	—	1	—	—	—	—	—	—	—
Clinchfield	—	—	—	—	—	5	1C	—	—
D&H	—	—	—	—	—	—	1C	—	—
D&RGW	52	—	34	3	—	96	108W	108C	—
DT&I	—	—	—	3	—	—	—	—	6
EJ&E	—	—	—	2	5	5	6W, 4C	6C	3
EL	—	—	—	—	—	—	14C	—	—
Frisco	16	—	—	—	—	—	6C	—	—
ICG	25	20	50	—	28	—	—	—	—
KCS	—	—	10	—	—	—	—	—	9
KCT	—	—	—	—	—	—	2C	—	—
L&N	28	—	2	3	6	6	56W, 2C	56C	—
MEC	—	—	—	—	—	—	2W, 5C	2C	—
MBTA (Boston)	—	—	—	1	—	—	15C	—	1
MTA-LI	50	—	—	—	—	—	6C	—	2
Milwaukee Road	8	2	—	5	10	2	26W, 1C	26C	—
MKT	—	—	—	5	—	—	—	—	—
MP	—	—	—	—	25	50	250W	250C	—
C&EI	—	—	—	—	4	8	15W	15C	—
T&P	—	—	—	—	9	18	180W	180C	—
N&W	—	—	—	—	—	—	166W, 18C	166C	8
PC	—	—	—	—	—	—	180W, 22C	180C	—
PATH (NY-NJ)	—	—	—	—	—	—	6C	—	—
Reading	—	—	—	—	1	—	3C	—	—
Rock Island	35	—	—	—	—	—	—	—	—
Santa Fe	—	—	—	—	—	—	—	—	10
SCL	32	—	—	—	—	—	—	—	—
Soo Line	2	—	1	—	—	18	—	—	—
Southern	116	—	6	—	—	12	26C	—	—
SP	110	—	7	5	41	108	27C	—	—
Union	—	—	—	—	—	—	1C	—	—
UP	136	—	20	5	20	4	—	—	—
WP	50	—	4	—	—	—	—	—	—
Totals	**1,793**	**255**	**425**	**1,850**	**375**	**1,037**	2,977W 438C	1,468A 1,505C	109

the alarm controls to indicate dragging equipment as well as hotboxes.

Also, the increased emphasis on safety by the Federal Railroad Administration, the increasing number of derailments, and availability of fewer persons along the right-of-way to observe fosters greater reliance on automatic safety detection devices.

Classification yard construction will be relatively active in 1974 with new yards just started at Louisville by Louisville & Nashville; at Waycross, Ga., by Seaboard Coast Line; at Barstow, Calif., by Santa Fe; and continuing progress by Burlington Northern at Minneapolis on Northtown Yard.

Many railroads are replacing older retarders with newer models capable of handling cars of 160 gross tons. Additionally, several roads—such as Santa Fe at Argentine and Union Pacific at North Platte—are upgrading existing retarder yards with new, solid-state control systems. At each location, there is a new, computer-controlled yard as well as an older manually-controlled retarder yard. These latter yards are being upgraded.

• **Transit signaling gains.** Transit authorities in the U.S. and Canada plan to spend $41.7 million on signaling in 1974; up 8% from 1973 spending plans.

OVER 1,000 ROAD-MILES OF CTC INSTALLED IN 1973

Railroad	Highway Grade Crossings protected by: Flashing-light Signals	Flashing-light Signals & Gates	Block Signals & Traffic Control: Road Miles	Electric Switches	Electric Locks	Signals	Train Stops Cab Signals	Interlockings: No. of Plants	Power Switches	Signals
Alaska	3	—	—	—	—	—	—	—	—	—
Algoma Central	4	—	—	—	—	—	—	—	—	—
Atlanta & St. A. Bay	1	—	—	—	—	—	—	—	—	—
BART (San Francisco)	—	—	38	—	—	—	150ATC	13	63	—
B&M	1	3	21	1	2	8	—	1	1	—
BN	70	45	87	16	23	105	—	—	—	—
CN	118	28	153	44	35	152	—	3	—	15
CP Rail	112	5	15	5	2	12	—	1	13	9
CNJ	—	1	—	—	—	—	—	1	3	—
NY&LB	1	3	—	—	—	—	—	—	—	—
C&O	25	10	—	—	—	—	—	—	—	—
B&O	10	5	—	—	—	—	—	—	—	—
C&NW	41	10	—	—	—	—	—	1	1	1
C&WI	—	—	4	—	—	2	—	—	—	—
CTA (Chicago)	—	—	8	—	—	12	10ATS, 6CS	—	—	—
Clinchfield	1	—	—	1	1	5	—	—	—	—
D&H	2	3	—	2	1	—	—	—	—	—
DT&I	—	1	—	—	—	—	—	—	—	—
AA	1	1	—	—	—	—	—	1	4	—
EJ&E	2	—	—	—	—	—	—	—	—	—
EL	1	6	—	—	—	—	—	3	3	5
Frisco	17	5	—	—	—	—	—	—	—	—
GB&W	4	—	—	—	—	—	—	—	—	—
ICG	39	8	17	2	4	13	—	2	—	—
KCS	9	1	107	9	12	71	—	—	—	—
LV	1	2	—	—	—	—	—	2	6	9
L&N	11	1	14	5	4	21	—	2	—	16
MEC	7	—	7	—	—	3	—	1	9	4
MTA-LI	—	21	6	—	—	—	CS TK CKTS	2	5	5
NYCTA	—	—	—	—	—	28	32ATS	2	11	16
Milwaukee Road	36	5	9	3	1	8	—	—	—	—
MKT	7	1	—	—	—	—	—	—	—	—
MP	39	10	41	2	—	25	—	—	—	—
C&EI	2	3	46	7	18	43	—	1	—	—
T&P	15	3	—	—	—	—	—	—	—	—
Montreal UCTC	—	—	1	—	—	1	1ATS	—	—	—
N&W	20	8	80	10	19	80	—	9	15	8
PC	40	25	24	6	5	11	—	18	32	18
PATH (NY-NJ)	—	—	—	—	—	1	1ATS	1	5	8
Reading	3	2	2	2	3	9	—	—	—	—
RF&P	—	2	—	—	—	—	—	—	—	—
Rock Island	21	6	31	4	9	12	—	—	—	—
Santa Fe	28	38	271	—	—	—	—	—	—	—
SCL	69	32	10	6	10	31	—	5	6	24
Soo Line	15	6	—	—	—	—	—	—	—	—
Southern	40	15	97	37	84	44	—	3	35	30
SP	42	148	207	42	24	242	—	—	—	—
TP&W	1	—	—	—	—	—	—	—	—	—
TTC (Toronto)	—	—	3	—	—	75	—	3	4	—
UP	21	14	29	27	21	54	80CS	1	10	16
WP	4	12	—	—	—	—	—	—	—	—
Totals	**884**	**489**	**1,328**	**231**	**278**	**1,068**	**150 Auto. Train Control 44 Auto. Train Stop 80 Cab Signal Locos**	**76**	**226**	**184**

OVER 300 DRAGGING EQUIPMENT DETECTORS INSTALLED IN 1973

Railroad	Detectors: Broken/ Loose Wheel	Detectors: Clearance	Detectors: Dragging Equipment	Detectors: Hotbox	Feet of Slide Fence	Spring Switches	Electric Switch Lamps	Switch Heaters	Yards- Retarders Switches	Miscellaneous Signal Units
B&LE	—	—	2	2	—	—	10	6	—	1
B&M	—	1	3	—	—	2	30	6	—	30
BN	—	—	7	7	—	—	—	—	—	—
CN	—	—	8	8	6,600	2	—	150	—	—
CP Rail	—	—	—	1	330	—	—	54	2S	—
C&NW	—	—	—	12	—	—	—	—	—	—
C&WI	—	—	—	—	—	—	—	—	—	1
D&H	—	—	—	—	—	—	—	2	—	—
D&RGW	—	—	12	1	10,000	—	—	4	12S	4
DT&I	—	—	—	1	—	—	—	—	2R	—
EJ&E	—	—	1	1	—	—	—	—	—	—
EL	—	—	—	—	—	8	—	—	—	—
Frisco	—	—	4	4	—	—	—	—	—	—
ICG	—	—	—	10	—	—	—	—	—	—
KCS	1	—	—	—	—	—	—	—	—	—
KCT	—	—	—	—	—	—	—	83	—	—
LV	—	—	—	—	—	—	30	3	—	—
MEC	—	1	—	—	—	—	—	—	—	1
MBTA (Boston)	—	—	—	—	—	—	—	35*	—	1
MTA-LI	—	1	—	—	—	—	—	—	—	—
NYCTA	—	—	—	—	—	—	—	1	—	—
Milwaukee Road	—	—	—	—	—	—	—	1	1R	—
MP	—	—	10	10	—	—	—	—	—	—
CE&I	—	—	1	1	—	—	—	—	—	—
T&P	—	—	6	6	—	—	—	—	—	—
Montreal UCTC	—	—	1	—	—	—	—	—	—	—
N&W	3	—	3	—	—	—	—	32	—	3
ON	—	—	1	2	—	—	—	—	—	1
PC	—	—	3	3	—	—	—	—	2R, 18S	—
Reading	—	—	—	—	—	—	—	—	—	10
RF&P	—	—	—	—	10,000+	—	—	—	—	—
Rock Island	—	—	1	1	—	—	—	—	—	—
Santa Fe	—	—	24	18	—	—	—	—	1R	—
SCL	—	—	16	16	—	—	—	3	—	2
Southern	—	—	158	2	—	—	—	—	19R, 46S	8
SP	—	1	57	20	—	2	—	—	146R, 226S	66
TP&W	—	—	1	—	—	—	—	—	—	—
UP	—	—	—	12	11,088	—	—	36	—	—
WP	—	—	—	2	—	—	—	—	—	3
Totals	**4**	**4**	**319**	**140**	**38,018**	**14**	**70**	**416**	**171R, 304S**	**131**

+10,000 ft of fence with vehicle detector system on fence separating highway expressway from railroad right-of-way
* Third-rail heaters

Major projects for existing systems are the installation of cab signal equipment in cars and wayside and track circuit controls. Also, Washington's new system should see the beginning of the installation of its automatic train operation system during the coming year. Down in Atlanta, final engineering designs are under way. Toronto is extending its Yonge Street line, and final testing is about to begin on the final section during 1974. Baltimore and Buffalo are in late planning stages of their rapid-transit systems which will include automatic train operation and control as a major system concept.

Existing transit authorities are modernizing their signal systems. Chicago Transit Authority, for example, is installing cab signaling on its North-South line and the Douglas Park elevated line. Bids have been opened on 100 new cars which, along with existing cars will be equipped with cab signals. New York's latest cars are being provided with controls for automatic train operation or cab signaling when money is available for providing the track circuit controls.

• **Communications spending drops.** Communications spending plans for 1974 show decreases: Railroads' spending will be off 23% to $127.8 million and transit authorities will be off 28% to $10.7 million. Major reason is that most properties are well covered for present communications needs. Also, many roads and transit authorities have switched some money to the signaling area to meet higher priority needs, and to projects where the return on the investment is greater. For ex-

TWO-WAY RADIO CONTINUES STRONG GROWTH RATE

Railroad	Two-way Radio			Intercom Systems			No. of Microwave Stations	Telephone	
	Mobile Units	Fixed Stations	Portable Units	No. of Systems	Loud-speakers	Telephones		Exchanges	Stations Available
Algoma Central	12	—	3	—	—	—	—	—	—
Atlanta & St. A. Bay	—	—	5	—	—	—	—	—	—
BAR	1	2	11	—	—	—	—	—	—
BART (San Francisco)	47	26	103	24	480	50	—	4	100
B&LE	8	—	9	—	—	—	—	—	—
BN	317	26	98	—	—	—	62	2	—
CN	600	65	520	8	70	—	23	4	800
CP Rail	200	23	220	—	—	—	—	—	—
CNJ	2	1	1	—	—	—	—	—	—
Chessie System	14	12	72	—	—	—	—	3	100
C&NW	194	8	13	—	—	—	2	2	210
C&WI	—	—	—	1	24	—	—	—	—
CTA (Chicago)	2	—	—	—	2	2	—	—	12
CTS (Cleveland)	14	—	3	—	—	—	—	—	—
Clinchfield	8	—	10	1	1	2	—	—	—
D&RGW	11	—	24	1	50	—	—	—	—
DT&I	10	1	35	2	6	—	—	—	—
AA	2	—	2	—	—	—	—	—	—
EJ&E	5	—	1	1	3	—	—	—	—
EL	—	—	4	—	—	—	—	—	—
Frisco	161	23	231	2	10	—	14	—	—
GB&W	—	—	4	—	—	—	—	—	—
ICG	66	6	60	—	—	2,000	6	3	—
KCS	60	—	330	—	—	—	3	—	—
KCT	—	—	4	—	—	—	—	—	—
LV	10	1	10	—	—	—	—	—	—
L&N	103	12	200	7	4	—	—	—	—
MEC	5	—	2	—	1	1	—	—	—
MBTA (Boston)	—	5	62	30	700	50	—	—	—
MTA-LI	5	3	5	—	—	—	—	—	—
Milwaukee Road	55	5	160	1	30	—	—	—	—
MKT	18	21	14	—	—	—	—	—	—
MP	14	1	10	2	20	—	—	—	10
C&EI	21	4	14	—	—	—	—	—	—
T&P	6	4	6	—	—	—	—	—	—
Montreal UCTC	4	—	2	—	—	—	—	—	—
N&W	119	102	464	1	13	—	—	—	—
PC	377	87	4,237	—	—	—	—	—	—
PATH (NY-NJ)	—	—	9	2	—	41	—	—	—
Reading	8	1	10	—	—	30	—	—	—
Rock Island	20	2	4	2	2	—	—	—	10
Santa Fe	—	3	—	—	—	—	6	1	—
SCL	279	21	361	1	10	—	—	1	—
Soo Line	103	1	30	—	—	—	—	—	—
Southern	164	57	284	5	35	250	4	1	100
SP	500	75	100	13	65	10	34	2	259
TP&W	20	2	—	—	—	—	—	—	—
TTC (Toronto)	—	—	—	1	—	—	—	—	—
UP	301	31	152	3	18	—	7	2	600
WP	39	—	39	—	—	—	4	—	—
Totals	**3,905**	**631**	**7,938**	**108**	**1,544**	**2,436**	**165**	**25**	**2,201**

ample, if a railroad can replace an attended manual interlocking with an automatic plant it can eliminate around-the-clock operators. This type of signal project often has more appeal than adding communications channels.

Too, 1974 may be the year for communications engineers to take stock of where they are, and what they have to do for future growth needs. Many have been under pressure for the past few years just to catch up to expanding needs of voice traffic, and especially in the data communications area due to extensive computer usage.

Still, the modest expenditures slated

(Continued on page 31)

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Computers: Battling the budget—and the "interline" problem

The computer is a magnificent machine—when its capability for making relatively-simple calculations at lightning-like speed is properly taken advantage of.

Over the years since railroads first recognized what the computer could do—in batch processing, for the most part—great advances have been made. As Southern Pacific Vice President-Management Services James W. Germany pointed out at the recent national forum of the Transportation Data Coordinating Committee, "Computerization is playing a vital role in our industry by providing increased capability to manage the complex and dynamic environment which is railroading. Few businesses must control and direct their resources—so many of which are truly productive only when they are in motion—over such a large and varied geographic area as the railroad industry. It's this fact that has spurred the railroad industry to be first a pioneer and still a leader in the application of computer telecommunications systems to operations control. These telecommunications systems have become very sophisticated, and they are directed at effective freight car control, locomotive control and train monitoring, while at the same time providing necessary management information for better freight yard control. The very important by-product of the on-line telecommunications system becomes the input for accounting systems and for a broad array of managerial analyses.

"I'm proud to say that there are great railroads in this country which don't have to take second place to any other private enterprise in the quality of their computerization—either hardware or software. These railroads saw pretty clearly what they could do with computers. They made the hard decisions to move into the new field, and they found the determination and, somehow, mustered the resources to make great progress."

Because of the situation existing in the industry today, however, many hard decisions remain to be made. As Germany put it, "Computer projects for our industry must somehow fit within the severe budget constraints that exist today, and before winning a place in the budget they must compete for a share of the budget dollar with expenditures for such absolutely basic needs as rail, ties, ballast and fuel—all of which items are sharply up in price. There's also the additional layer of competition between computer projects that contribute to internal control and those that promise pay-offs in interline activities. Thus it's not difficult to see why systems that are directly related to the internal efficiency of an individual company will usually range higher in priority than those aimed at interline relations where the benefits are harder to identify quickly or where those benefits may accrue nationally sometime in the future as opposed to directly on an individual railroad's balance sheet this very year.

"For example, Southern Pacific just recently opened in southern California a freight car classification terminal that we believe we can prove is the world's most advanced. We call this West Colton Yard our piece of 'tomorrow's railroad that is already here today.' Thanks largely to a process-control computer system that makes a constant, almost unbelievable stream of calculations for each car as it moves along, this yard can classify about twice the number of cars per minute that most other modern yards can put over the humping crest. Obviously, a lot of money went into this sophisticated process computer system, and when I tell you that the entire yard cost $39 million, you will rightly conclude that this tremendous internal improvement to our railroad also put a strong squeeze on what we have been able to spend lately for other important computer projects we have on our shopping list."

"Exchange" problem

As for the industry (as opposed to individual-road) application of computer technology, Germany had these observations: "While I'm happy over that considerable progress we've been able to make, it's in the area of interline compatibility and data exchange where we as an industry have not made the progress we would like to see. Although our work to achieve interline compatibility has spanned quite a number of years, and although we can see solid accomplishments with the formation and acceptance of some interline code structures, we have fallen far short of having an inter-line capability that allows us to originate transportation information only one time and to have it passed through in turn to each connecting carrier without his having to re-originate the same information.

James W. Germany

"We have also been unable to exchange interline information in a manner that will allow us to measure our service performance from origin through to ultimate destination. For many of us, the approach for compatible code structures seems to have consumed too much time in getting the necessary agreements among all of the individual carriers, while too little time and effort have been dedicated to the objective of complete interline data exchange. To put it another way, we perhaps have wrongly viewed our problem as one of developing compatible code structures for each field of information rather than dedicating ourselves to data exchange which might be accomplished in a manner other than through detailed formats and codes.

"In the railroad industry, the basic document for the movement of a freight car from its origin to its destination is, of course, the waybill. Not only is this the major operating document, but it also becomes a major accounting document for the industry. This document can be relatively simple or it may be extremely complex, depending upon the nature of the shipment and the tariff requirements covering the particular movement. In any case, it's a document which still must accompany the car on its entire move and must be handled by each carrier and each of-

fice for each carrier where the car itself will be physically handled.

"With the capabilities of modern computers and communications, it now is technically feasible to have shipments move all the way from origin to destination with no paper documents at all accompanying the shipments. It is also technically feasible to handle all accounting in the same paperless fashion, for bills rendered to the shipper or consignee and for proper distribution of the revenue to each of the participating carriers. This 'paperless' future, however, certainly is far out yonder in time somewhere. Meanwhile, there's a need for an interim system not so dependent upon a high level of interline code and computer capability—a system that can lead to a future paperless shipment control in the shortest time span.

"With a recognition of the great potential of present-day computerization, I tend to be pretty impatient with the tedious manual paperwork waybill system currently in use in our industry. But as a realist, I must recognize that this system has served the industry effectively for many decades. Since it is the framework for much of the internal and interline accounting, it shouldn't and can't be eliminated without a great deal of thought, planning and effort.

"Within our industry, the documents, formats, framework and codes for the waybill structure certainly have a long history of precedent. While we might like to wipe out many of these precedents or somehow bring them more up to date, the time and effort and money required to do it make any completely revolutionary change exceedingly difficult in the short term. But a realistic challenge for the near term is to make a reasonable simplification of the transfer of information between shippers, carriers and consignees.

"The great cry that goes through meetings year after year can be summed up about like this: 'Let's eliminate this mountain of paper—some of it paper so illegible it can't be read by man or machine. And let's arrange to move the necessary information fast enough and accurately enough to enable us all —carrier and shipper alike—to make cost-cutting, service-improving decisions.'

"Well, we haven't achieved it, and we won't for a while. But that is no reason to lose sight of these perfectly reasonable objectives for one moment. They aren't an 'impossible dream.' They are, I'm sure, objectives that will eventually enable us to arrive at truly effective control of shipments all the way from the shipper through the various carriers to the consignee with a minimum amount of paperwork and very possibly none at all.

"Meanwhile, so far as the railroad industry is concerned, while we continue to work toward the ultimate objectives, we can't and we aren't going to stand still when there are other avenues open to us for making improvements in the short term. Thus the industry has come to place its hopes for simplification of paperwork in the Repetitive Coding System, which is not dependent upon the full acceptance of code structures for each field of information relating to a shipment nor upon changing the current waybill system.

"The repetitive waybill code is a code assigned to those shipments that are equivalent to past shipments that have moved. With the use of repetitive waybill code, the shipper and each carrier and the consignee all need only to know the repetitive waybill code number to produce any required information they might need. Studies have indicated that 60% of the total carload traffic is susceptible to Repetitive Waybill Coding. Several railroads are already using RWC for on-line shipments, and tests are being conducted on an interline basis.

"To differentiate between the terms Repetitive Waybill Coding (RWC), Repetitive Rating, and Computerized Rate Retrieval—As we know, there actually are trillions of different railroad freight rates, although only a small percentage are ever really used. While a rate retrieval and application system is very desirable, this is quite an elusive goal and we should not forego the interim benefits possible with RWC. Automatic rate application for repetitive shipments is possible, but keeping these rates current and accurate is a significant maintenance problem.

"While the interline exchange of waybill information is basic to the transportation system, physical movement monitoring and control are equally important in assuring transportation reliability. Several railroads today are working on computer systems capable of developing schedules for each car movement all the way from origin to destination. The aim of these systems is not only to measure origin-to-destination performance but during the movement to contribute to on-time performance by continuously monitoring the progress of the car and notifying those responsible for the movements where failures are predicted unless timely corrective action is taken. These future potentials hold great promise for improved reliability of service and for better equipment and resource control.

"In addition to the areas of operational and accounting control, computers in the railroad industry are being harnessed to aid the planning process at all levels of management through the development of network simulation models, line capacity models, long-range corporate planning models, and financial decision models. These developments are leading to the capability for rail management to use the computer as a method of evaluating alternative decisions before they are actually implemented in the field."

Germany also saw progress on an industry basis: "The work that has already been done and is currently in progress by the Association of American Railroads is contributing substantially to the development of interline information exchange that certainly holds a promise of industry-wide improvements not too far in the future. The AAR's current TRAIN II project, although directed more specifically to the control of the car fleet of the U.S. railroads, also offers the expansion capability for service performance monitoring and operational waybill data exchange. The TRAIN II system design permits each of the individual railroads to report from its own computer system into the AAR computer system in Washington a greater detail of physical location and status change than has heretofore been possible under the TRAIN I system."

Whose computers?

Southern Pacific's James W. Germany talks of railroads as pioneers in computer use and as leaders still among all industries—and the figures bear him out. The most recent AAR survey of computer installations in the United States and Canada shows approximately 125 computer-installation locations, and the use of about 250 separate computers. Including AAR itself and various rate associations, the user list covers some 80 companies and other organizations.

In terms of individual computers in service, Canadian National and Penn Central each show 22 units, followed by Chessie System and Southern Pacific with 18, Santa Fe with 12, Union Pacific with 11 and Burlington Northern with 10. In terms of number of locations where computers are installed, the readout shows Santa Fe, BN, CN and Kansas City Southern with units at six points and SP and PC with installations at five locations.

Not surprisingly, IBM is far and away the leader in number of computers in service, with close to 180 out of the total plus-or-minus-250. After IBM come RCA/Univac, General Electric, Honeywell, NCR, Collins and Burroughs. And, while major roads are among the users of other-than-IBM equipment, significant market penetration among smaller railroads has been made by the computer manufacturers competing with IBM.

RSC People

FRISCO: Lyle D. Reed, manager transportation data systems, named director of administrative systems and procedures, Springfield, Mo.

GENERAL CABLE CORP.: Gertraud Schmidt appointed assistant director of research, Union, N.J.

GENERAL ELECTRIC CO.: William P. Bartley named manager, engineering services, Telecommunication Products Department, Lynchburg, Va.

LOUISVILLE & NASHVILLE: In the Communications Department at Louisville, **F. R. Wix** appointed communications engineer; **R. A. Hicks,** administrative engineer-communications; **L. M. Tingle,** electronic engineer; **Q. K. Clay,** communications system designer; **P. C. Rabuzzi,** microwave engineer; **W. J. Webb,** communications equipment supervisor; **M. L. Qualkenbush,** communications circuit designer; **A. L. Fegenbush,** wire crossing and contract coordinator; **E. W. Turner** and **P. P. Ash, Jr.,** assistant project coordinators.

McGRAW-EDISON CO.: Edison Battery Division promoted **John J. Swiss** assistant district manager, to district manager, San Ramon, Calif.

RAILWAY SYSTEM CONTROLS: Al Klinger appointed editor of **Railway System Controls,** succeeding **Robert W. McKnight,** who has become editor of the **Signalman's Journal.** Klinger will also serve as communications and signaling editor of **Railway Age.** A native of Sioux Falls, S.D., Klinger is a graduate of the U.S. Army Signal School at Fort Monmouth, N.J., where he subsequently taught for two years. He will be headquartered at Simmons-Boardman's New York offices at 350 Broadway. McKnight joined Simmons-Boardman in 1951 as associate editor of Railway Signaling & Communications

L. D. Reed
Frisco

Al Klinger
RSC

(now Railway System Controls) and became editor on April 30, 1958, upon the retirement of John Dunn from that position.

ROCKWELL INTERNATIONAL CORP.: Robert C. Wilson, president, **Collins Radio Co.,** elected a vice president of **Rockwell,** effective with the merger of Collins into Rockwell. **George M. Cayce,** staff vice president-financial planning and analysis, elected controller, to replace **Charles E. Ryker,** named staff vice president, western controller's office.

UNION PACIFIC: Edmond E. Leege named safety engineer, Omaha.

WABCO: Union Switch & Signal Division appointed **Donald D. Huffman,** manager, engineering; **Andrew J. Carey,** manager, systems engineering; **Charles W. Wall,** manager, railroad industrial controls, and **G. Lawrence Trenga,** supervising engineer. **Westinghouse Air Brake Division** named **Daniel W. Jamieson,** manager-financial projects and analysis. **Union Switch & Signal Division** also named **L. H. Stecker** supervising engineer.

WARREN G-V COMMUNICATIONS: Edgar Zimont appointed product marketing manager.

D. D. Huffman
US&S

A. J. Carey
US&S

C. W. Wall
US&S

D. W. Jamieson
WAB

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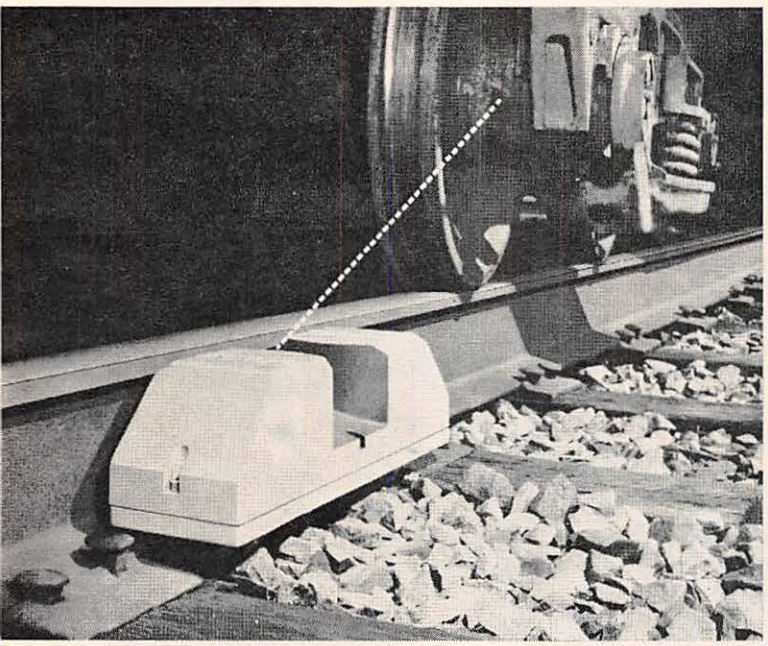

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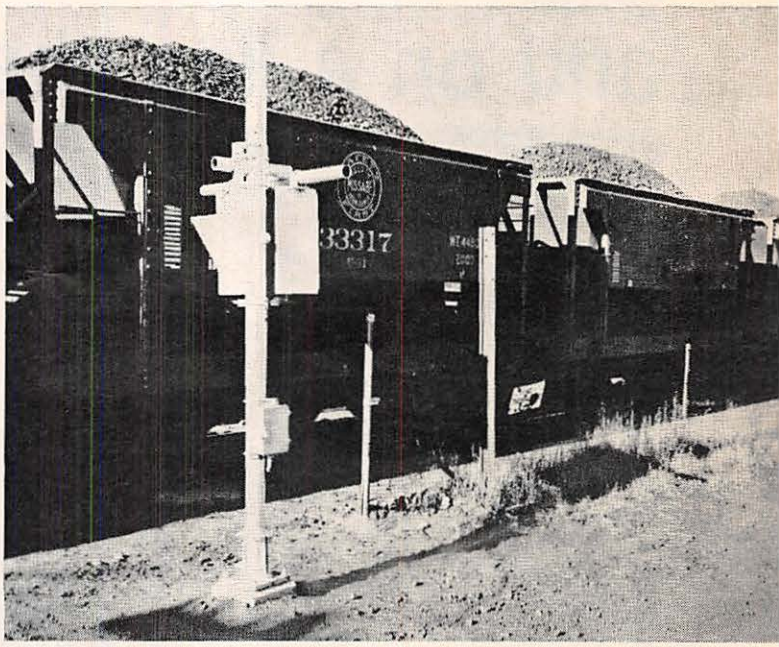

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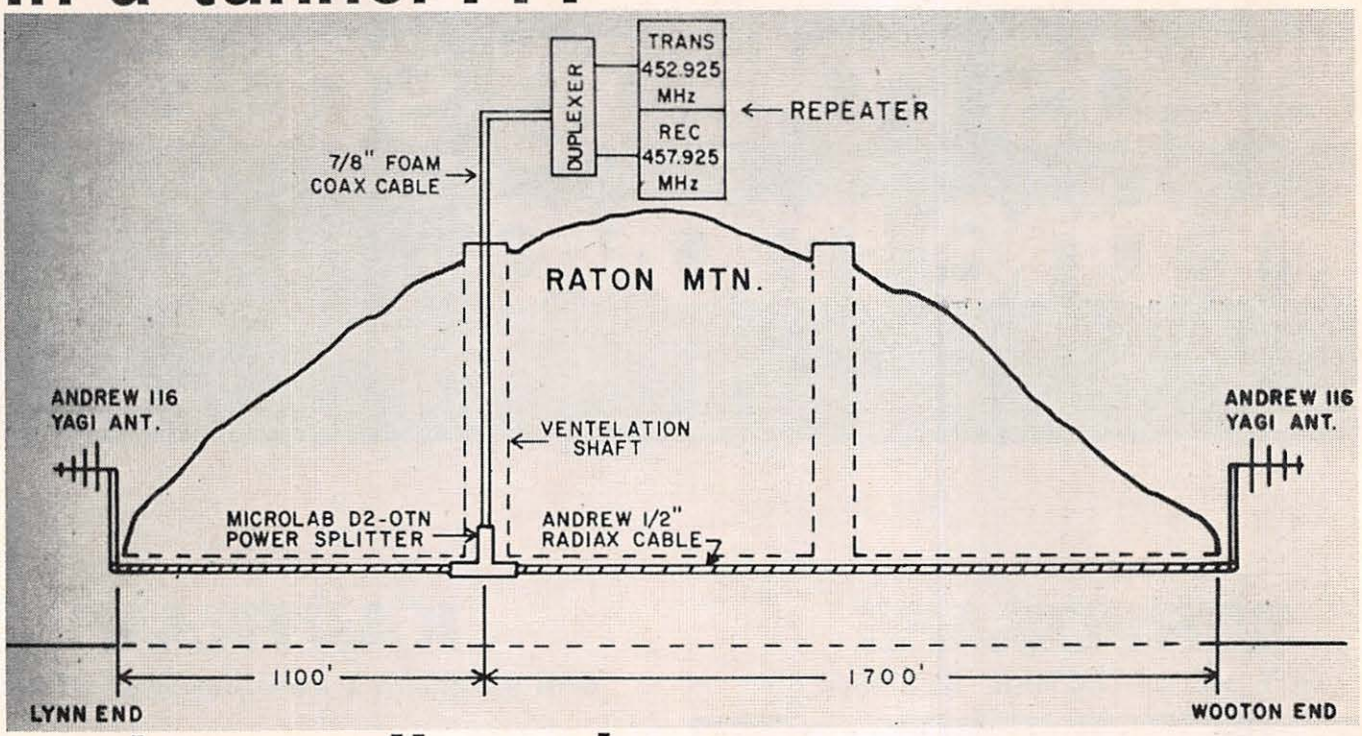
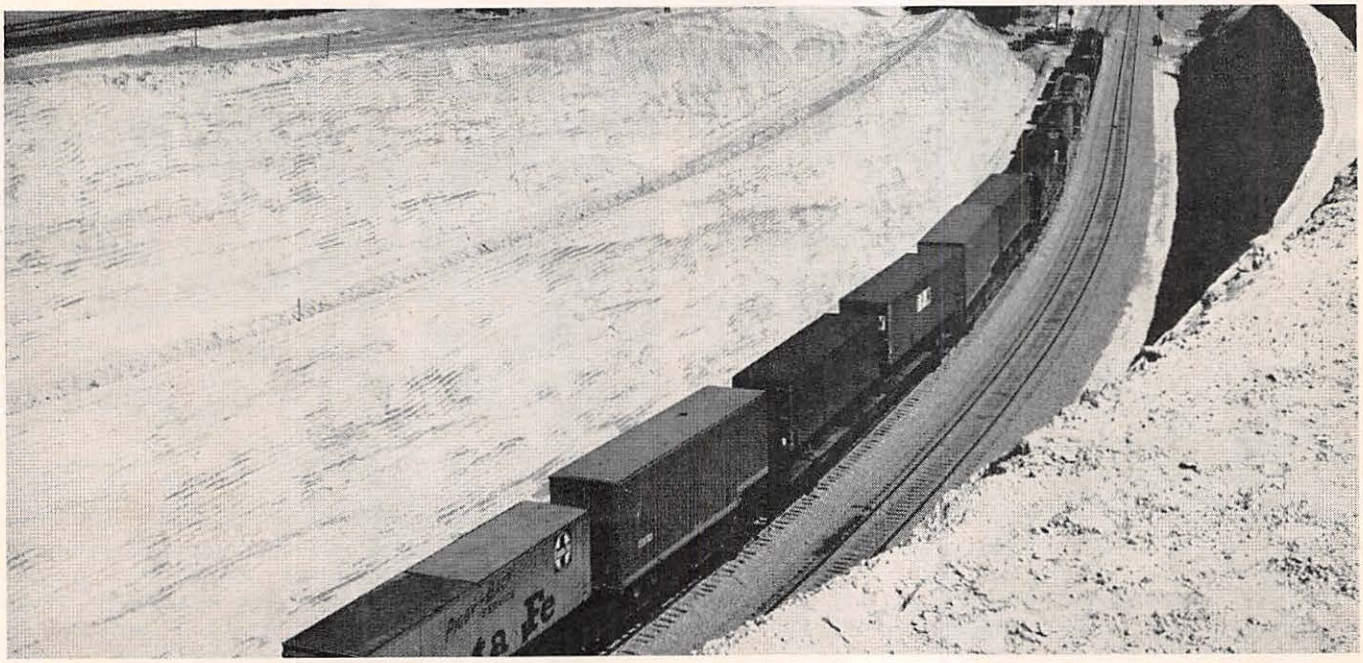


and on a line-change



Santa Fe solves a "slave" problem

Use of remote-controlled locomotives has grown considerably in recent years—in unit-coal-train operations but also in other operations in which mid-train helper power is needed. Generally, operations have gone smoothly. But, there have been a few problems with communications. H. L. Massie, assistant superintendent-communications, system, of Santa Fe, talked about problems—and solutions at Raton and Summit—at the recent C&S meeting.

"Although slave locomotive control equipment has many built-in features to achieve fail-safe operations, including the effect of temporary loss of the radio communications link, there are situations where the predictable loss of communications is undesirable—such as areas where track grade changes require changes in remote locomotive powering condition. If radio propagation obstructions are present in these areas, a repeater system of some type is usually required to insure control.

"The use of 450 MHz, or UHF, band

for slave locomotive operation has several advantages which simplify repeater operation. First, the Federal Communications Commission has provided the railroads with two UHF frequency pairs having 5 MHz separation which readily permits simultaneous reception and retransmission of slave locomotive communication signals. Secondly, there is the availability of UHF communication units with dual front end receivers and channel scanning that automatically switch from direct to repeater links. Thirdly, the easily-installed, high-performance, radiating-type coaxial cable provides a reliable, controllable, long-distance signal path. Also, as VHF radio installations are usually in close proximity to the UHF slave locomotive installations on locomotives and at base stations, the wide 160-450 MHz frequency separation provides ample system isolation to prevent interaction problems.

How it works

"In remote controlled locomotive UHF radio communications link operation," Massie noted, "the system normally communicates on the direct link F1. The repeater is designed to simultaneously receive on F1 and transmit on F2. Its transmitter is activated by an RF input signal that provides at least 20 DB receiver quieting and is kept activated by employing a 28-second time-delay circuit. The transmit time of the slave locomotive equipment is approximately 200 milliseconds and occurs at normal intervals of 21 seconds. Therefore, the repeater will stay activated as long as a slave locomotive train is within communications range.

"With the slotted coaxial cable now being used in many installations, the slots in the cable allow a portion of the transmitted RF energy to run along the entire length of the cable. Conversely, a signal transmitted near the cable will couple into these slots.

"Although Santa Fe operates slave-locomotive-equipped trains utilizing UHF radio over a large portion of the railroad we have found it necessary to provide repeater systems only at two locations to eliminate operating problems. The first system was installed in June 1972 for the Raton Tunnel, in the northeast corner of New Mexico. A second repeater was installed in February 1973, at Summit, Calif., near San Bernardino.

"The Summit repeater was needed," Massie said, "to cure propagation problems caused by an extremely deep cut made as a part of a curve-reduction line-change. We were unable to utilize techniques of antenna positioning and slotted cable, as we were not permitted any exposed cable installations—apparently for environmental and esthetic reasons. Therefore, the simplest repeater approach was utilized, that is, an Omni directional antenna to saturate the near areas, which in turn illuminate the obstructed areas with deflected and reflected signals. We selected the type of antenna and its height to just adequately cover the approach areas.

"At Raton we have a 2,800-foot tunnel at the crest of the pass with near 3% grades on each side, again requiring several changes in locomotive powering conditions. However, approximately 10 to 15 miles on either side of the tunnel the terrain is essentially flat. This created somewhat of a problem—to provide adequate tunnel approach coverage without extending the coverage into the level terrain where it is not needed.

"Tests indicated we would have trains 60 to 70 miles apart within radio range of each other through the repeater if antennas located at the crest adjacent to the repeater equipment were used.

"In the particular case of Raton Tunnel we were able to provide the desired coverage by utilizing the tunnel entrance cuts, feeding Yagi-type antennas from the ends of the slotted coaxial line and optimizing the position of these antennas within the cuts.

"We were able to obtain coverage of approximately one mile on each side of the tunnel with sufficient shadow losses to prevent overshoot coverage.

"Raton Tunnel was constructed with two intermediate ventilation shafts, one of which was utilized to run ⅞-inch coaxial cable into the tunnel to permit locating the repeater equipment convenient to AC power and access roads. This also permitted us to feed the slotted coaxial cable at the desired point near the center of the run.

"Since operation of trains through the area after the installation was completed indicated the repeater system was quite satisfactory, it was decided performance measurements should be taken to establish a data base for engineering future systems and determine the long-term stability of the performance of the slotted cable. In August 1973 we retested the performance of the antenna-coaxial cable system and were unable to detect any deterioration of the performance as originally measured. There are approximately 10 to 12 trains daily operating through this tunnel. The tunnel interior is essentially dry and stays at a temperature of approximately 45 to 55 degrees Farenheit."

As for actual installation, Massie pointed out, "Since tunnel interior coverage was most critical, the farthest tunnel entrance from the power splitter was used as the controlling design point. In the reverse direction the repeater transmit is 60 watts, plus 47.8DBM, and the slave equipment receiver has a sensitivity of approximately one microvolt, minus 107 DBM. For all practical purposes there is no directional advantage.

"The cable was positioned on the side of the tunnel wall approximately 15.5 feet above the rails to place it in closer proximity with the slave locomotive antennas and yet keep it as far away as possible from the heat and exhaust emissions of locomotives.

"Performance tests were conducted using a motorcar equipped with a 20-watt UHF transmitter powered from a 12-volt heavy-duty battery. A coaxial-type antenna was attached to the motorcar and positioned so as to have an antenna center 15.5 feet above the rail to simulate a slave locomotive antenna. The transmitter power was monitored at all times to insure the measured results were valid.

"To record the receive carrier at the repeater site, a Hewlett Packard spectrum analyzer equipped with an 8555A RF head was connected through a 3 DB power splitter in place of the repeater equipment. The calibrated cathoray vertical deflection voltage was used to drive a varian model G1010 chart recorder.

Measure and mark

"The trackage was measured off in 500-foot intervals and marked. These markers were called off by VHF radio communications outside the tunnel and the UHF transmitter output was momentarily disabled to mark the chart. As in most areas confined by steel bar reinforced concrete a pronounced standing wave pattern was found. While there is a 10 to 15 DB variation in signal strength, a median value was determined for each 30-foot section. These median values were used to construct a plot of the received carrier power.

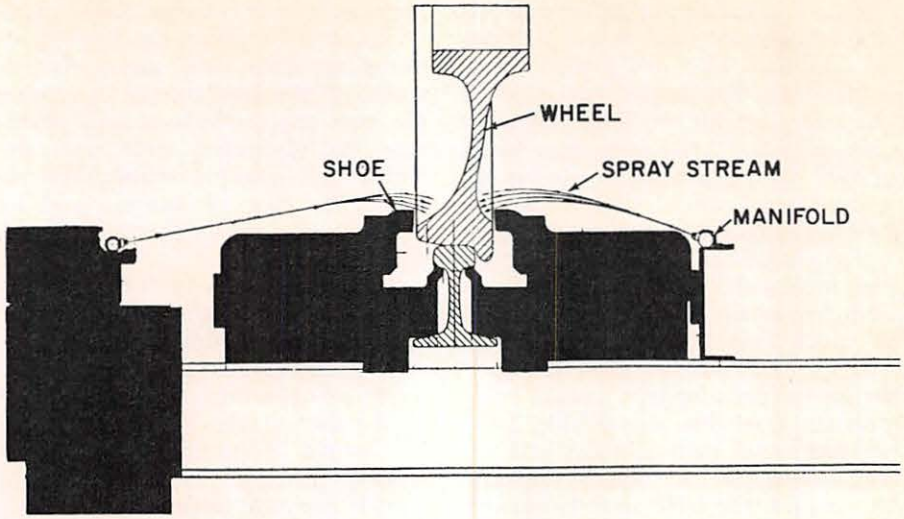
"Also plotted are the results of an initial measurement made when the station was placed in service. This curve was obtained using a 20-watt transmitter keyed on a lead slave locomotive. While the test equipment used was not as accurate as that later used, it should be noted the power curve is flatter and does not follow the nominal cable attenuation curve. The test train was operating in a direction that took it from the Wooten end to the Lynn end of the tunnel.

"The results indicate coupling loss factor is drastically modified when the transmitted energy is more closely confined by the train occupying the single track tunnel."

Retarder noise—I

Lubricate—and knock out screech

(A railroad freight yard is not and never has been a quiet place. But, with noise-pollution control now being legislated—sometimes to the point of the ridiculous—railroads and suppliers have been stepping-up control R&D, as was pointed out in detail at the recent C&S Section meeting. One presentation, dealing largely with a lubrication solution, came from D. E. Turner, manager-product engineering of General Railway Signal.)



CUTAWAY DRAWING OF THE GRS SYSTEM shows locations of the manifolds and the direction of the spray stream—which must be kept low against the wheel to insure that the lubricant is not carried away by the wind and lost.

"GRS has carried out a number of experiments in seeking a solution to the problem of eliminating the airborne noise generated as a result of the stick-slip mechanism as wheels are braked in a car retarder. This experimental work was conducted on Burlington Northern at Pasco Yard, and a wide variety of devices was included in the tests including barriers, various retarder shoe materials, shoe inserts including carbon blocks and stick lubricants as well as a wide range of mechanically-applied solid and liquid lubricants.

"While many of these devices were successful in either reducing the level of the noise or the number of incidences, none was considered acceptable as a long-term solution. In some cases, the material or applicator had such a short life it was unacceptable. In the case of the lubricants, the fundamental problem was how much to apply. It is true that many lubricants are available which will eliminate the noise—but unfortunately, they also eliminate retardation. At least one oil was found which, if very carefully controlled, would eliminate the noise and at the same time allow the retarder to be effective in braking without excess loss. However, as a long-term solution it was not feasible because of the difficulty in applying just the right amount. Too much oil was the rule, with high loss in braking.

"While we were being continually brought back to lubricants as a solution," Turner recalled, "in May 1972 an experiment was carried out using a commercial soluable cutting oil in solution with water. The test equipment consisted of a 55-gallon drum for mixing and storage of the liquid and a small motor-driven irrigation pump which delivered the solution to lengths of perforated garden soaker hoses laid along the retarder shoe beams. This arrangement produced a fine spray mist which enveloped the car wheel as it passed through the retarder. The results were quite dramatic as compared with previous experiments. For the first time we were able to demonstrate clearly that noise had been eliminated when a car passed through the retarder, using this scheme. However, there were still some cars which appeared unaffected. The noise levels from these were as high as ever and, naturally, unacceptable.

"But, we were encouraged, and the same test rig was used to apply other mixtures of soluable oils. As these experiments progressed, an oil with a higher percentage of pressure agents and anti-seize additives was found which virtually eliminated the screech from all cars. Furthermore, and of equal importance, all of this occurred with very little loss in retardation."

"Keep it low"

To meet the specifications for Burlington Northern's Northtown Yard at Minneapolis, Turner pointed out, a system must be provided which will be practically free from airborne screech resulting from retarder action: "After evaluating carefully our prior experiences and experiments, it was decided to proceed with a 1973 version of the soluable oil spray system as the only viable solution. The reasons for this decision? First, work done by others in this field indicated that some type of lubrication system is an approach which will work. Second, experimental work by GRS had produced a potentially workable solution. Finally, the specifications require a solution which is basically 100% effective. Sure, there are other potential solutions, but these are only partially effective. Experiments show that when noise of this type occurs, it is usually at a very high level. Solutions which produce *some* reduction generally produce a rather small reduction—10 to 20 db—as compared to the over-all level of 100 to 130 db. Classical industrial-plant approaches to noise control which rely on the principle of containment just do not work with retarders."

Recent efforts, Turner said, have been directed at finalizing the oil spray configuration for Northtown Yard. Further development was carried out at Burlington Northern's Minot Yard during the winter of 1972-1973, to optimize the nozzle configuration, spray pattern and oil-water ratio: "The winter climate at Minot also makes it an ideal place to carry out cold-weather experiments. It is obvious that an oil-water mixture alone cannot be used under freezing conditions. Antifreeze was added to the water to lower its freezing point in the same manner you add it to your car radiator. At this point, though we knew the solution would not freeze, we did not know what effect the antifreeze would have on retardation. Comprehensive tests of retardation were conducted with and without spraying. The loss in retardation was measured as less than 10% of the total. There is, furthermore, indication that retardation may be more uniform from car to car, and that in some cases the surfaces of the wheels are actually cleaned. The lubricant also provides the additional benefit in aiding the wheels in negotiating the curves further down in the yard."

The success of this system, Turner said, centers around several factors:

—The spray completely covers all

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New York, N.Y. 10013

surfaces of the wheel as it passes through the retarder. There is no dependance on "tracking down" or carrying along the mixture from one section of the retarder to the other, or from retarder to retarder. There is, therefore, no metering of the liquid involved since it is simply a matter of having it present when the shoe and wheel meet.

—Because of the relatively small percentage of oil in the solution, usually less than 5%, there is no problem in getting too much on and losing retardation. If more material than is required to cover the wheel is sprayed on, it simply runs off, and the oil in solution goes with it.

In the final form, according to Turner, the system will be made up of pipe manifolds along each side of each rail through the retarder: "It is important that the spray be kept low to insure it is not carried off by the wind. The manifolds are designed with quick disconnects for ease of removal required for maintaining the retarder. The nozzles are four feet apart and are supplied at a pressure of about 20 psi, although this is adjustable to meet local conditions. The supply for each section is controlled by a solenoid valve which will be opened by the automatic retarder control system during the time a car is present in the retarder. Since noise does not normally occur at light shoe pressures, it is expected that only cars over about 50 tons gross weight will be sprayed. This, of course, is easy to input from the automatic control system.

Another trouble?

"On either side of each retarder, a noise barrier is provided extending upward eight feet above top of rail. The barrier is made up of a series of panels so arranged that the inside faces toward the retarder are not parallel in any plane with that panel on the opposite side. This is to provide maximum opportunity for sound absorption by the barrier lining, which consists of acoustically absorptive material covered with plastic film for protection. These barriers will not stop airborne noise directed upward or towards the retarder ends, but will be beneficial in reducing that traveling perpendicular to the retarder. The barrier also acts as a wind shield to prevent blowing and drifting of the spray."

Environmental problems, however, don't end with noise-control:

"As is frequently the case, the solution of one ecological problem adds to another—in this case, the potential ground contamination from the oil spray. An oil collection and recycling system is provided to protect. A concrete pad extends under each retarder. This pad slopes inward and down toward the leaving end. A drain connects the low point to a sump outside the retarder. In this way, all the excess oil and water is drained from the retarder area for recycling. Between each retarder is the collecting sump consisting of a round, precase concrete pipe into which is placed a submersible pump controlled by a high-low limit switch. In addition, a cycle timer is provided to limit the frequency of operation of the pump. This allows the sump to be pumped dry once after the start of a heavy rainfall, after which the sump is allowed to overflow the relatively clear water into an industrial sewer. The amount of oil remaining in the collection system under these conditions is small and can easily be handled by the sewer with no problem. This insures at the same time that excess water does not get into the noise-control system and dilute the mixture beyond a useful level.

"The discharges from all the sumps is collected in a settling tank where the excess heavy contamination is removed. It is then pumped through in-line filters which remove the small particles of dirt. From here the clean oil and water moves to a sampling and mixing tank. Each time the tank is filled to a predetermined level a sample of the mix is drawn off to determine the proportion of each ingredient and from this the amount to be added to provide a full tank of the proper concentration. The appropriate amounts of oil and antifreeze are drawn from storage tanks through meter valves. The water is added from the city supply, also through a meter. The entire contents of the tank is agitated to produce a homogeneous solution. The refreshened mixture is pumped into a storage tank from which it is distributed to all retarders at the required pressure.

"All the tanks and most of the pumps are centrally located in an enclosure for ease of operation and maintenance. The entire system has been designed to hold a 24-hour supply of material. Bulk storage of raw materials provides for over a one-month supply. Approximately three gallons of the dilute mixture will be used per car sprayed when the system is operating. At least 50% can be recovered, and under favorable conditions this may exceed 75%. The consumption of oil, therefore, may be as low as 75 gallons per day."

Turner's conclusion? "Although, the use of a lubricant to control unwanted noise in a friction device such as a retarder goes against all reason, in this case a tiny amount of the right material with a large volume of water as a carrier does the job—and does it effectively."

Retarder noise—II

One problem, many ways to fight it

(How many ways are there to deal with retarder noise and how many approaches are there to solving the problem? Robert Karow, manager-terminal markets of WABCO's Union Switch & Signal Division, gave this outline, also at the C&S Section meeting.)

"Noise in classification yards has been a problem for a number of years, probably starting with the first retarder. A review of prior experiments and testing shows a wide variety of approaches to alleviating noise, but no quantitative data was ever published, so no usable conclusions could be reached from these tests. During the latter part of 1970, the subject was revived and became acute, due to a local ordinance that set allowable sound pressure levels for the proposed Northtown Yard on Burlington Northern.

"In this ordinance, maximum permissible levels for noise were set at 35 to 40db at night, and only slightly higher in the day time. A good part of the problem is that such figures are totally unrealistic. For comparison, 35db is about the level of a whisper. We made measurements of common noises at Southern Pacific's Eugene Yard and found that the ambient level with no cars moving was 80 to 85db. A switch engine idling past at about 100 yards was 90 to 95db. Generally, when we hear a car squeal, we are talking about something above 100db. We've recorded as high as 134db 15 feet from a retarder. This is very close to the threshold of pain. Fortunately, sound decays with distance from the source so that characteristics can provide a partial solution at some locations.

"At about the same time as BN was faced with the Northtown ordinance, Santa Fe had a labor grievance involving retarder noise at Argentine Yard. Early in 1971, Southern Pacific also began looking into the problem in connection with its new yard at West Colton. All of these activities were related to the ever-increasing emphasis on ecology and environment. Therefore, something had to be done. Our approach was to do the best we could with the noise, even though the requirements of certain ordinances appeared to be im-

possible to meet."

At the time the specifications were being written for Northtown, Karow said, "Burlington Northern contacted suppliers of retarders for cooperative efforts with their sound consultant, Bolt Baranek & Newman (BBN). General Railway Signal and Abex began work with BBN and Burlington Northern at various locations. WABCO elected to study the problem in conjunction with the American Standard Research Center. Both efforts progressed along similar lines, beginning with the identification of the noise source. An early conclusion was that the car wheel is the sound generator. It is set into vibration by the stick-slip phenomenon between wheel and brake shoes called spragging. As the wheel is squeezed, it tends to be gripped and then slip, somewhat like a piece of chalk chattering on a blackboard. The resulting vibration causes the wheel to squeal. A number of tests to eliminate the noise by damping the retarder beam and shoe mechanism were tried by BBN, GRS and Burlington Northern, but with no success. These included filling the top of the beam with sand, loading the beam with sand bags, and increasing the beam mass with sand boxes slung underneath. Additional tests to deaden the wheel were attempted by pressing wood planks against the wheel above the retarder. These, too, were unsuccessful due to clearance problems. A test of a sound deadening material applied to the wheels of a heavy car was planned, but never carried out due to their not having such a car available for a long enough period of time. This might have been an academic exercise anyway, due to the magnitude of applying such a solution to all cars. If an answer can be found by working at the wheel-shoe contact point to eliminate the vibration, a more economic solution will result.

Once it starts . . .

"One of the most important results of our preliminary testing was the discovery that, regardless of which device or modification was in use, once a wheel began to squeal, it squealed just as loudly. Therefore, WABCO, working with various railroads and the research center, decided to approach the problem on two fronts simultaneously."

The first objective, Karow said, "was to find some manner, as quickly as possible, to reduce the over-all intensity of the wheel squeal. The second program was aimed at finding some method, or combination of methods, to reduce the percentage of cars that squealed to absolute zero.

"In regards to our first objective, reducing the intensity of the sound level, a sound barrier was designed by American Standard Research and submitted to Burlington Northern for construction at North Kansas City. To develop a standard for comparison, sound measurements were made by WABCO at Argentine, North Kansas City and Eugene Yard in the summer of 1971. The barrier was erected by BN and sound measurements were taken in October 1971. This provided a partial solution. The first design reduced the level by about 20db. A later version reduced the level by 25db. We were granted a patent on this barrier design in July of last year.

Then, shoe tests

"In addressing the second objective we investigated a number of possible solutions: Different shoe materials, changes in the retarder arrangement, changes in retarder control, and lubrication.

"Southern Pacific compared sound tests on normal shoes at Eugene with sound measurements of softer, un-heat-treated steel shoes. The conclusions from these tests were that no appreciable reduction in squeal resulted and shoe wear was substantially greater. The latter conclusion was also reached by CNR at Edmonton."

Following the unsuccessful attempts with softer shoes, Karow said, Southern Pacific requested shoes made of ductile iron: "Ductile iron shoes are produced by a casting process rather than the rolling operation that is used for standard steel shoes. The grade of ductile iron used has about the same hardness as the soft steel shoes we tested, but the metallurgical content and molecular structure are different. Ductile iron contains a fair amount of graphite. Ductile shoes were installed at Eugene, and test results indictated some reduction in the number of cars that squealed.

"While the various other tests were being carried out, the use of composition shoe materials was investigated. The 3M Company was approached first, in cooperation with BN, but 3M quickly concluded that there was either no readily available material and/or the size of the market did not warrant a research effort. The problem was then taken up with Johns-Manville through the WABCO Air Brake Division because they had jointly developed the Cobra brake shoes for train braking. They investigated the use of such materials and concluded that none possessed sufficient mechanical strength to withstand the forces encountered in a retarder application. A number of people in the industry still felt this was the route to go, so we had a special shoe made with Cobra material in a dovetail slot in a standard shoe. This shoe lasted for 86 cars.

"At about this same time, our engineers conceived the idea of interrupting the retarder beam and shoe arrangement. It had been observed that the buildup of vibration to produce squealing seemed to require some amount of time, varying from 10 to 30 feet of retarder length. At Taylor Yard on Southern Pacific in Los Angeles, a rebuilt retarder was installed with entering and leaving beams every three cylinders to create an interrupted retarder. Ductile shoes were also used in this test. The results of these tests showed a further reduction over the Eugene tests, in the number of cars that squealed. Throughout all of the tests on Southern Pacific, we had been exchanging information with BN and CNR. The CN Research Department had tested a modified retarder control circuit which showed a great deal of promise in providing a substantial reduction in noise. It had been felt that retarder noise was a function of the amount of pressure applied. Based upon this assumption, they developed a ramped voltage circuit, using a wired program analog computer, to provide retarder control that would bring a car down to the desired velocity at a constant rate of deceleration over the complete retarded length, rather than the standard approach, which retards a car at the maximum rate until it is down to speed, and then controls the car to that speed throughout the remainder of the retarder length.

"Squealers" down

"Without the ramp voltage, most of the retardation takes place in the first half of the retarders, which incidentally, also increases shoe wear and the stresses on the retarder. The actual test results? First, a car with the standard retarder control entered the retarder at 12.5 mph and was brought down to the requested exit speed of 7.5 mph under conventional control in about the first half of the retarder. In the second case, using ramp speed control, another medium-weight car that entered the retarder at 14.5 mph was brought down to the requested exit speed of 6.5 mph progressively throughout the length of the retarder. The circuit creates a ramped voltage and outputs this as a constantly-decaying speed request. This voltage is, theoretically, a sloped straight line. The resulting velocity is slightly wavy. This is due to the reaction time of the control circuit and retarder combination.

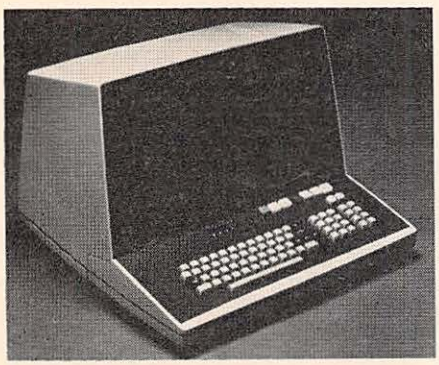
"The results of several days of testing by CN and our tests at Argentine and North Kansas City indicated a 50% reduction in the number of heavy cars that squealed, and an even greater reduction with medium-weight cars using

(Continued on page 32)

RSC Product News

Data set

The 261A Data Set uses the synchronous duobinary encoding technique combined with FSK modulation to transmit and receive data signals at 2,400 bits per second. Operating over a type 3002 voice-frequency channel, C1-conditioned or better, the unit is end-to end compatible with the manufacturer's 26C-30016 Data Sets equipped for the same functions. Built-in test facilities include switchable compromise equalizers, VF and digital loopback switches and a random pattern generator. *GTE Lenkurt Inc. Circle 101 on Reader Service Card.*



Display terminal

The DESIGN III series of complete CRT display terminals features a contemporary molded-case design which contains a 14-inch CRT monitor and building-block circuit cards which are directly interchangeable with the manufacturer's Series 200 modular display controllers and keyboards. Operating speeds to 9,600-baud asynchronous are standard. The display terminals are delivered plug-compatible with user's equipment. A remote video port is included, from which up to 10 EIA standard 525-line video monitors can be daisy-chained for simultaneous local or remote viewing. Double-size characters, external synchronization, strip chart and full graphics, printer add-ons and multidrop systems are among the typical optional configurations. *Ann Arbor Terminals, Inc. Circle 102 on Reader Service Card.*

Minicomputer

The IMAGE/2100 minicomputer system is designed to give access to chains of records in up to five different data sets by a single key value and to a single detail record by as many as five different key values. It provides the full range of data access methods and will prompt the operator for proper input. It can automatically link master records to detail records with matching key values and also handle logically related detail records by key value. *Hewlett-Packard Co. Circle 103 on Reader Service Card.*

Teleprinter

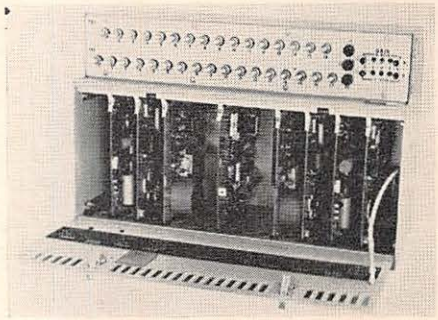
The EDT 300 MSR, a 30-character-per-second teleprinter with a magnetic-tape cassette buffer has a keyboard send/receive (KSR) configuration which can be used for both data-entry and polling applications. The buffer is designed to operate on-line independently of the printer, on-line with the printer or locally off-line with the printer. It is said to add a 60-cps and 120-cps transmitting and receiving capability to the EDT 300 KSR's basic speeds of 10, 15 and 30 cps. The unit is arranged for EIA RS232 direct connection, as well as into a customer-supplied Bell System 202C-series data set or its equivalent with reverse channel. *Western Union Data Services Co. Circle 104 on Reader Service Card.*

Solid-state relays

An improved line of all-solid state relays includes a SPST, d.c.-input version, the MSR200B (N.O. output contacts) and a SPST, a.c.-input version, the MSR202B (N.O. contacts). An input of 2.5 volts energizes the d.c. model. It de-energizes at 1.4 volt. The a.c. model energizes with 90 volts a.c. or 45VDC. Both models switch up to 280 volts a.c. RMS at 10 amps load current. *Monsanto Commercial Products Company. Circle 105 on Reader Service Card.*

Radar meter

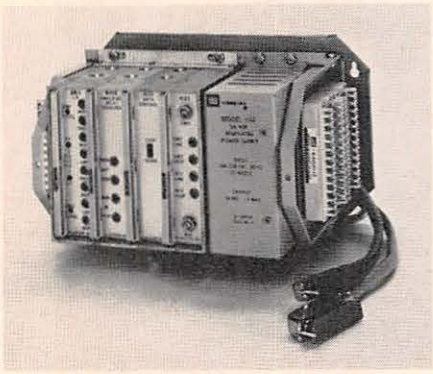
A digital hand-held radar speed meter with dual-speed range is designed to operate in miles-per-hour up to 199 miles per hour and in tenths of a mile per hour up to 19.9 miles per hour. The unit operates from a small battery pack which has a charger for overnight charging from a 115-volt outlet. Calibration can be checked by pushing a button. The unit will remain calibrated throughout its normal temperature operating range which is −30 degrees F to 140 degrees F. By releasing the button, readings can be locked in display. The antenna, which is circularly polarized, utilizes a Gunn Oscillator and Schottky Barrier Diode. *West Bend Autotronics, Inc. Circle 106 on Reader Service Card.*



Protection assembly

The 7A200-14 PMTC is a double-track crossing protection assembly housed in the new PMTC case utilizing standard AAR terminals. It contains two PMTC systems with island circuits, one per track. Each system has an East receiver module 7A220 and a de-

modulator module 7A230, a West receiver module 7A220 and demodulator module 7A230, and an MRTC/SRTC island circuit module 7A380-X, which gives a total of 10 modules in the 7A200-14 PMTC. PMTC transmitters are located at the approach starts for each track. The PMTCs and island circuits output relays are designed to operate conventional directional logic circuits and a common XR relay. *Safetran Systems Corp. Circle 107 on Reader Service Card.*



Data station

The 820 Data Station is designed to interface between four-wire private lines and two- or four-wire data sets with plug-in module options for end-to-end signaling, loopback DDD data backup, low impedance interface for up to three telephones, adjustable equalization for amplitude/delay distortion, and protection against hazardous voltages. According to the manufacturer, the system provides full data or full data alternate voice features. *Wescom Inc. Circle 108 on Reader Service Card.*

Control accessory

Wall-mounted DESKON II is a remote control accessory for two-way radio communication. The unit is designed to permit a remotely-located base station to be controlled with d.c. or tone controls via a voice-grade telephone line. The unit can also be used as a monitoring and push-to-talk extension for dispatching in the radio system and for internal position-to-position intercom capability. Depending upon total system configuration, up to five units can be used in parallel with other remote controls. The standard model has a built-in speaker/microphone. An optional handset is available. *General Electric, Communication Systems Division. Circle 109 on Reader Service Card.*

Steel housings

Cor-ten steel housings for railway signal equipment are designed to combine the weather-resistant qualities of aluminum and the strength of carbon steel. The material is said to be corrosion resistant and to develop a tightly adherent protective oxide film on its surface when exposed to weather. Color ranges from dark brown to purple-black after oxidation. *WABCO. Circle 110 on Reader Service Card.*

Crossing kits

New railroad grade-crossing protection kits have been designed for the use of private companies. The kits, which range from simple to sophisticated systems, include flashing lights, cantilevers, gates and other equipment needed to insure safe crossings. Light units are prefocused for maximum visibility. Masts and cross-arms are rewired for double-security protection. *Harmon Electronics. Circle 111 on Reader Service Card.*

Microwave systems

The Series 4600 Link Alignment System has both a microwave signal and two-way voice communication which are said to simplify antenna alignment in microwave communications relay system installation and maintenance. The system consists of two small microwave transceivers with two-way circuits operating at 6 GHz. The accessories include a remote meter, carrying case, battery pack, headset, and horn antennas for coarse alignment.

The Series 1691 Fault Locator for testing microwave transmission-line systems has its own signal source, resolves multiple discontinuities and is portable. It is designed to measure the magnitude of a fault to ±1 dB over a 40-dB return loss range. Distance display resolution is 0.1 foot over a 0-500-foot range. *Scientific-Atlanta, Inc. Circle 112/113 on Reader Service Card.*

Base station

The MICOR Base Station has total solid-state construction said to make it less vunerable to power failures, transmission delays, and equipment problems. The units have flexible cabling and are modularly constructed. They are available in upright cabinet installations or in 30-inch or 40-inch compact cabinets. A high-performance transmitter is said to decrease interference between users in crowded radio environments. A sensitron receiver permits the dispatcher to receive weak signals in high-density areas. A power control circuit is built into all MICOR base stations to give full performance even if the antenna shorts or disconnects. Intermittent-duty-rated models have a temperature-control circuit to keep the transmitter from overheating and causing damage. There are units for local control installation, extended local control installations for up to 100 feet from the control point, and remote control for greater dispatcher flexibility. *Motorola Communications & Electronics Inc. Circle 114 on Reader Service Card.*

Call decoder

A dispatcher call decoder features selection of 89 stations, answerback station verification, and is completely self-contained with solid-state circuit dependability. Designed to replace the manufacturer's early 60-style selector system, the dispatcher call decoder unit is a tone-activated decoding system for use on dispatcher telephone lines to selectively alert one or more specific stations to an incoming call. The two-digit system permits selection of up to 89 stations. When the proper tones are received at the station selected, the tones are decoded and a call lamp on the front panel is lighted and an audible, two-second alarm is sounded to alert the operator to the dispatcher's call. When the audible alarm is operated by the incoming signal, an audio (answerback) tone of approximately 2,200 Hz is transmitted back to the dispatcher to verify that his call has reached the proper destination. The call lamp will remain lighted until the operator presses the lamp reset pushbutton on the front panel. If the operator is busy on other circuits and cannot press the lamp reset pushbutton, incoming calls will be received with the lamp on or off. *Safetran Systems Corp. Circle 115 on Reader Service Card.*

Voltage converter

A DC voltage converter gives 33 volts DC. The 10-amp unit is designed with a completely isolated output and can furnish closely regulated power to train-control equipment on railroad locomotives and mass-transit cars. According to the manufacturer, the unit can withstand the severe mechanical vibration, shock, and extreme temperature ranges encountered during day-to-day service as well as voltage transients common on locomotives and transit cars. Output current limiting protects the unit from overload or short circuits. Reverse polarity protection is also provided. *Vapor Corp. Circle 116 on Reader Service Card.*

Optical reader

The MDR Optical Mark Reader is designed to translate source data into computer-compatible formats. The units are said to be capable of reading pencil marks, punched holes, preprinted marks or computer-imprinted marks that appear on card-size or page-size documents. *Bell & Howell Co. Circle 117 on Reader Service Card.*

Chargers

AutoReg Chargers—series ARK—are available in single-phase 24- and 48-volt units with ratings up to 7½kw. Features include dual-voltage transformers with two-pole circuit breakers, changeover which does not require changing of circuit breaker of fuses, DC voltage adjustable ±10% in normal or equalize setting, ±1% voltage regulation from no load to full load with ±10% variations in the AC input voltage and current limiting adjustable from 90% to 115% of rating. *C&D Batteries. Circle 118 on Reader Service Card.*

Data set

The 26U-1200 Data Set is designed to provide asynchronous transmission of data signals at speeds of up to 1200 bits per second over a voice-grade telephone circuit. Compatibility to the Western Electric 202C Data Set for dial-up service, and to Western Electric's type 202D Data Set for private-line applications, excepting those W. E. models equipped with the five-baud AM reverse channel, is featured. Operating modes are half- or full-duplex over four-wire lines, and half-duplex over two-wire lines or dial-up circuits. Along with the primary channel, an accessory combining panel is available for simultaneous transmission of as many as three 75-baud channels, or one 150-baud channel and one 75-baud channel, over the same private-line circuit. All data and control signal circuits interfacing the data set with associated data terminal equipment conform to EIA standard RS-232C. Connections are made to the data set through a 25-pin EIA-type connector. Turn-around time is 20 milliseconds for private-line applications and 200 milliseconds for dial-up applications. Pushbutton switches on the front of the unit are used to select the desired private-line or dial-up mode of operation. Other front panel switches are provided for system testing on a local or loop-back basis. The 26U is seven inches high, seven inches wide and 11¼ inches deep. It may be operated from 115-volt or 230-volt AC, 50/60 Hz power sources. *GTE Lenkurt, Inc. Circle 119 on Reader Service Card.*

Test power supply

The Model C-R regulated power supply for bench testing of two-way radio equipment has remote control operation, dual output 1-20 volts DC, 0-4 and 0-40 amperes, adjustable current limiting on both ranges and voltage limiting. There is said to be no deterioration of performance when the power supply is subjected to an RF field. Models are also available which have 40 or 72 volts DC output. AC input is 115/230 volts AC, 50/60 Hz. Either voltage input can be selected internally of the unit by a terminal strip connection change. Cabinet size of the unit is 13 inches high, eight inches wide, 13 inches deep. *Lapp Co. Inc. Circle 120 on Reader Service Card.*

Measurement filter

Frequency measurements from 20 Hz to 18 GHz can be made automatically with an electronically-tuned YIG filter. Manual adjustment for tuning a cavity or phase locking an oscillator are not required, according to the manufacturer. By connecting the unknown frequency to the appropriate input connector, the correct frequency can be displayed automatically. To simplify the display and eliminate the need to interpret the legend and decimal point, an 11-digit display divided into GHz, MHz and Hz has been employed. When less resolution is required, the display can be further simplified by individual blanking control of the six least significant digits. The 351C has broad-band capability with FM and AM tolerance. With wide measurement capability, baseband, IF, and carrier frequency measurements can be made with one unit. *EIP Incorporated. Circle 121 on Reader Service Card.*

1974 S&C expenditures

(Continued from page 17)

for 1974 are by no means a pullback from the market place. L&N, Santa Fe, Southern, Southern Pacific and UP, for example, plan to install additions to their microwave systems in 1974. Norfolk & Western, plus Chessie System, will probably begin construction of microwave systems in 1974. Also in the microwave area, several railroads are replacing vacuum-tube equipment with solid-state systems.

VHF radio will continue strong, especially in the replacement market—that is, replacing tube equipment with the newer solid-state units. Much of the existing radio units in service are in the 10-to-15-year age category.

Telephone exchanges will continue at a fairly high installation rate, due mainly to increased costs from the commercial telephone companies. Private-line rates are under investigation by the FCC and the uncertainty of rates will spur railroads to provide their own communications circuits. In this respect, look to see more channel-sharing among railroads with private microwave systems. Thus, one railroad will provide voice channels to another road's off-line traffic offices while it receives similar circuits from the other railroad for its off-line traffic offices.

• **Transit gains.** Transit authorities are expanding their communications in the areas of data transmission, public address systems, telephone service and closed-circuit television. Some authorities are installing TV to observe station areas, particularly at fare-collection points where automatic fare-collection systems are in service.

Another major trend in transit communications is the widespread use of two-way radio on trains, buses and for police activity. System-wide, solid radio coverage is the goal of most transit authorities. As an aid to transit police, some transit systems are installing closed-circuit television for surveillance of passenger stations, particularly fare-collection areas, as well as on platforms for safety reasons.

So, 1974 will be a year of mixed blessings for signal and communications officers. As ever, there will be pressure to obtain the most from the money spent, and with generally rising costs, as well as some shortages in materials and equipment, it may be a frustrating year as well. For suppliers, 1974 will be a good year for sales to the railroad and transit industries—though material shortages could produce production/delivery problems.

Noise reduction in class yards

(Continued from page 28)

this method of control. There was no squeal with light cars in either case in these particular tests.

"This ramp control circuit was made-up in standard 5-inch by 7-inch printed-circuit-board form for the tests at Argentine and North Kansas City and has since been installed by CN for their retarders at Edmonton. It requires a minor amount of wiring changes to feed the circuit with the measured entering velocity and the calculated requested leaving speed from the normal speed control circuitry as well as battery connections.

"The remaining noise-reduction approach was the use of lubricating fluids at the retarder shoes. Oil spray equipment was supplied and installed by WABCO at North Kansas City and measurements taken at the same time as the post installation tests of the barrier. The lubrication equipment consists of a series of nozzles on a header pipe running down both sides of each rail, with a steel trough below the rail to collect the run-off. A water-soluble oil in a 10% solution was sprayed on all wheels as they passed, using the yard air supply to provide pressure. The spray was controlled manually with a switch and solenoid valve for these tests. Some other type of manual or automatic control would be needed for a permanent installation.

"Each of the tests was run with one, or no more than two, of the noise-reduction schemes at a given time. Of course, in each test, the squealers that were eliminated from the total population were those that were least susceptible to squealing.

No prediction?

"We knew of no way to predict what the lowest percentage of squealers would be with all of the arrangements in combination. So, this past July, Burlington Northern and WABCO put it all together at North Kansas City, using the group 1 retarder for tests. This is the retarder with the noise barrier. Group retarders 2 and 3, with standard shoes, were used as controls for the tests. The first set of data of these latest tests was taken with ductile iron shoes on the inside beams and with tapered entering and leaving beams installed at every third cylinder. The results of all noise-reducing arrangements in combination was zero squealers. We wouldn't want to go so far as to say that all these approaches in combination will guarantee to eliminate all squealers, because at some other yard, with some other mix of cars, with a different retarder pressure and different climatic conditions, on a given day, I'm sure there will be some car that will squeal. We can say, however, that these approaches will make a big dent in the number of squealers."

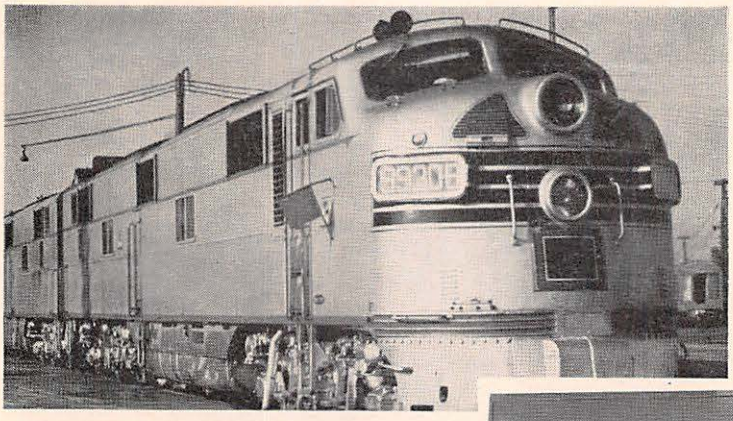
Wrapping it up, Karow made these points: "Once a wheel begins to squeal, it appears to the human ear that it squeals just as loud as it would have without any of the retarder modifications. Thus, we continue to recommend noise barriers, to take the top 25db off of any noise that is generated. It also provides visible proof to the community that something has been done, and after all, there is some emotion mixed in with the physical problem, so a little psychology helps too.

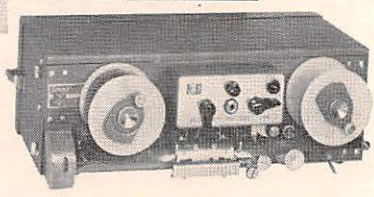
"There's also a little bad news about these noise-reduction arrangements that should be brought out. All of the benefits mentioned aren't achieved without some loss. The ductile shoes provide approximatley the same amount of retardation as the standard heat-treated rolled shoes, but the life of the ductile shoes when installed on the inside beams is reduced by about two-thirds. The interrupted beam approach, that is, entering and leaving beams at every third cylinder, reduces the retarder rating by 12%. Lubrication further reduces the retarder rating. The latest tests at North Kansas City indicate this loss to be around 25% and, of course, there's the additional cost of the spray equipment and oil and the oil recovery problem.

"There is a lot more work that can be done. We've been actively working on the problem for over two years with some preliminary tests going back several years before that. We owe a lot of thanks to CN, SP, Santa Fe and BN for their cooperation in all of the tests.

"A broader research effort that would include working with car wheels and retarders together is needed. This is beyond the signal suppliers' province and will require the cooperation of wheel and car builders. We plan to continue with other experiments on retarders which could run for several years. Our goal is a more economical solution. In the mean time, we think the arrangements tried so far either singly, or in combination, can provide an acceptable solution for most locations."

So, quiet in the classification yard? Not so many years ago, that would have been labeled as the original impossible dream. Railroad and supplier efforts today, however, make impossible look a lot more possible.





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'73 review: Record year—in some ways

If you had to sum up 1973 so far as the railroad industry is concerned, it could be done in two words: "Great, but . . . The reason: The industry performed more transportation service than ever before, 847 billion ton-miles worth, and it took in record-high revenues of roughly $14.6 billion—but total expenses also hit record-high levels, at about $14 billion, and so what was left wasn't much more than what has been left in any recent year. Rate-of-return on investment remained at a depressed 3%-or-so.

There were other records also set in '73. Total payroll climbed above $7 billion, and average employee earnings were at a new high. Employment, however, continued to decline, dropping below 520,000.

From a traffic standpoint, a couple of points deserve a comment:

—Grain traffic, reflecting increases in both export and domestic movements, were up by well over 20%.

—TOFC/COFC carloadings were up by about 15%, and the number of trailers and containers handled jumped by 18%. Both figures—1.5 million-plus carloads, 2.7 million trailer and containers, were new record highs.

—Despite the energy crisis and increased operation of unit trains, coal movements actually declined, probably due to environmental restrictions.

Capital spending for equipment and plant added up to approximately $1.35 billion, an increase of 11% from 1972. Railroads took delivery on about 60,000 new freight cars, up by almost 10,000 from year-earlier levels. Railroads also placed orders in '73 for approximately 100,000 new cars. Capital spending for fixed-plant improvements climbed by an estimated $440 million.

Last year was also the year in which railroads and rail labor organizations reached a pre-deadline settlement on new contract terms, without the need for crisis-creation and without the need for government intervention. The 18-month agreement, running through 1974, provided over-all employee-gains of 10.7%, including a 4% wage increase and railroad assumption of employee Railroad Retirement contributions over and above what employees would pay were they covered by Social Security.

Finally, 1973 was the year in which Congress acted on the Northeast situation, setting up the means by which bankrupt carriers may be restructured into a system which, hopefully, will be able to operate at a profit. Substantial employee-protection benefits were written into the law, as were detailed provisions for how and when the new Northeast system will be set up.

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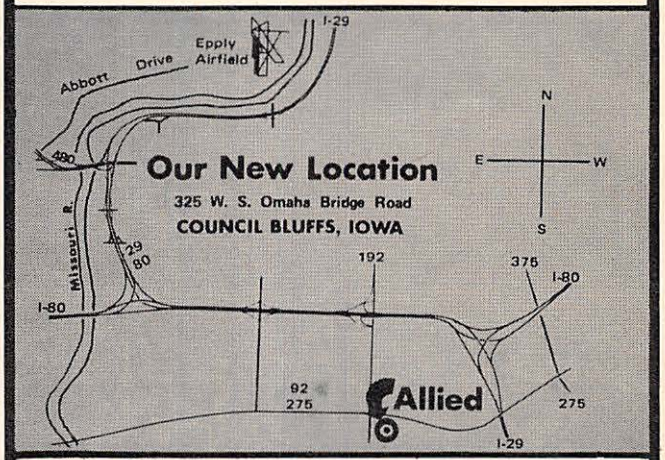

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Editor's corner

'74 outlook: The beat goes on—but faster

What kind of year will 1974 be for those whose interests are tied to the signaling, communications and data-processing areas of railroading? I predict that there will be some good news and some bad news. The good news is that there won't be too much bad news.

The energy crunch, whether it is temporary or permanent, real or trumped up, will have profound effects in the transportation areas. I happen to believe not only that the petroleum shortfall is real, but that it will be with us for a long time; that it was developing long before and without relationship to the boycott by the Arabs. A contemporary business magazine, Oil & Gas Journal, warned of impending shortages as long ago as 1970.

Even if fuel cutbacks create a reverse in the economy generally, the switch to the most efficient users of energy is inevitable, and that means us. It has taken the boycott to highlight the railroad industry in the eyes of the general public, who all too widely have viewed us as a "dying industry." Readers of RSC however are well aware that 1973 ended up as the greatest single year in nearly 150 years of American railroading in terms of tonnage handled.

This record level of traffic was moved on a somewhat reduced plant, with less multiple trackage, and that is where signaling and communications come in. Railroad men in 1974 are going to have to find ways to move even more tonnage over an infrastructure that cannot be rapidly expanded. What can be done quickly is to move more trains with fewer delays with new, improved and well maintained C&S facilities, with data transmission and processing as an essential adjunct.

RSC readers should have less trouble with budgets, but more difficulty in getting deliveries. Suppliers to the departments should find it a lot easier to get orders, but more difficult to get material and parts to fill them. But favoring the railroads is the fact that they are clearly essential to our industrial and agricultural economies, and they will have to be favored in allotment of any scarce materials. They have already been put in second-best position for scarce diesel fuel allotment, with 110% of 1972 set as a quota by EPA.

Whatever develops in 1974, the tempo will be at an accelerated pace. There will be more recognition of the importance of our departments. In summary, the whole enterprise should be more rewarding for those who contribute.

Robert G. Lewis, Publisher

'73 review: America woke up

Tomorrow's railroad historians, it might be noted while we're looking ahead to 1974, are going to have a tough time in summing up '73.

For railroads, was it:

—The year of the Northeast?

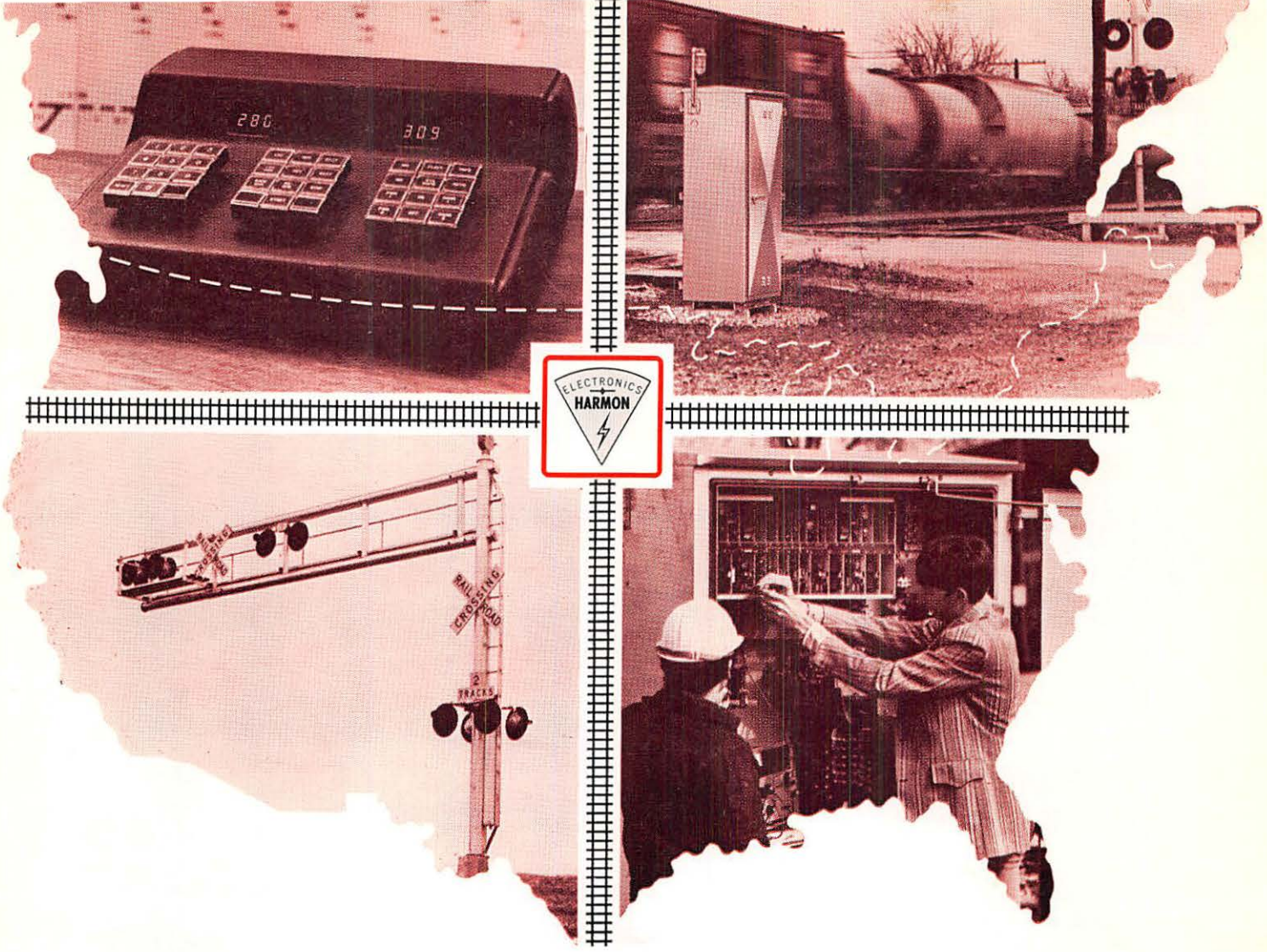
—The year of peaceful collective bargaining (hopefully to be followed by a lot more of the same)?

—The year of the crunch (energy, inflation and so forth)?

—The year when America woke up to what its railroads mean?

—The year in which the key phrase could have been "onward and sideways," from a results-standpoint, since the industry did more than ever before and profited from it only a bit?

Our vote, at this point, goes to "The year when America woke up to what its railroads mean." And the waking-up, of course, includes elements stemming from the Northeast, from labor peace, from the crunch. As for results—check back in a year. Things may just get better—for all concerned.



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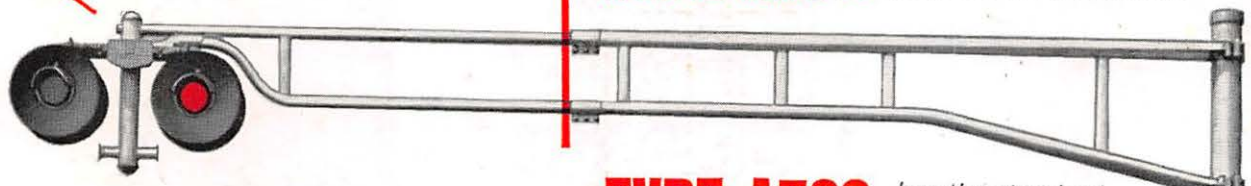

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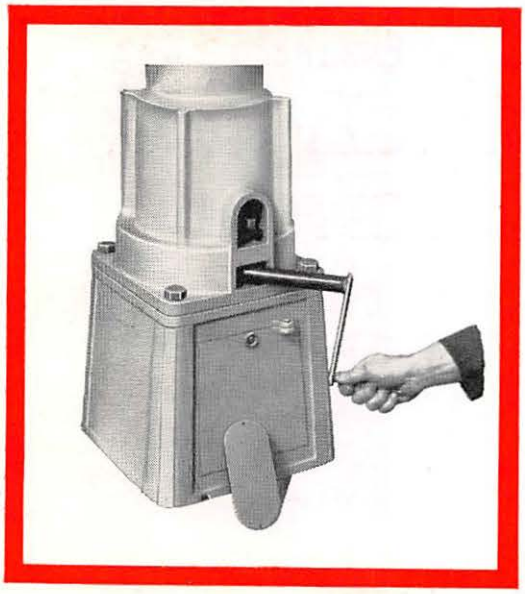

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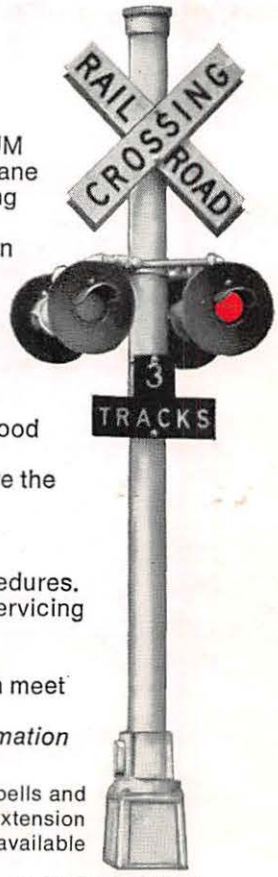

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